February, 1943

Railway Engineering and Maintenance

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

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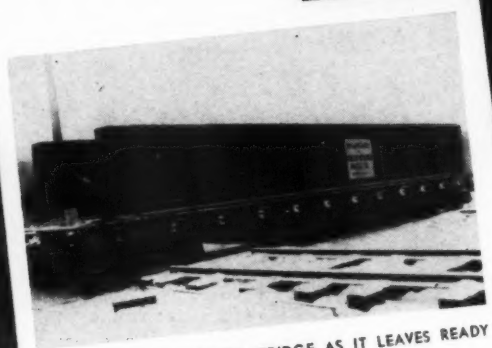

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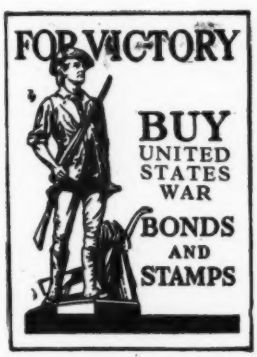

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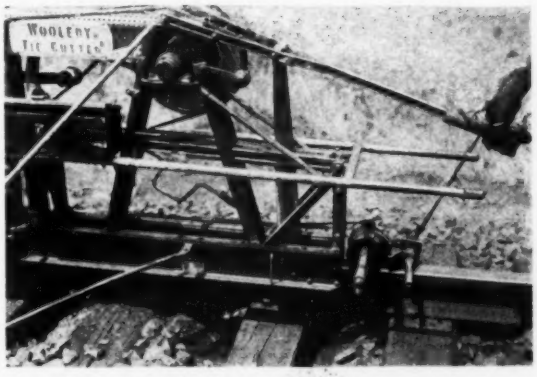
Can Become
BOTTLENECKS

WAR

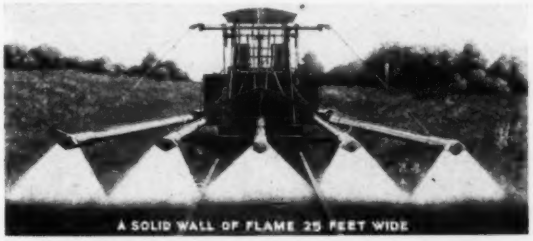
against Waste of Manpower

....*Use* WOOLERY TIE CUTTERS



Compactly built, the Woolery Tie Cutter can be operated on the track and moved on or off track by one man.

The Woolery Tie Cutter works equally well in stone, gravel or in any other type of ballast.



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while steel saves lives

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ARMCO ARMCO **EMERGENCY PIPE**

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DON'T LET CORROSION SABOTAGE YOUR RAILS

Transportation men realize that today—with its continuous twenty-four hour rush of peak traffic—rails must do double, triple duty. And they must not fail because of corrosion—the invisible saboteur that attacks steel that is not adequately protected.

That is why the extra factor of safety and protection which RMC PLASTIC provides against corrosion of steel in rail joints is so greatly needed now. The more severe the conditions of operation, the greater is the need of RMC PLASTIC.

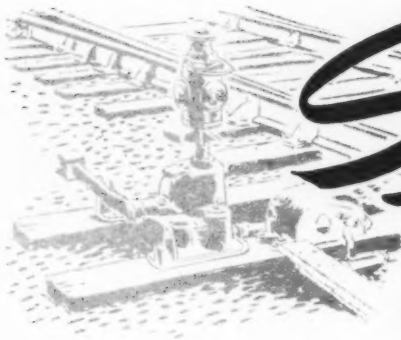
Rail joints, with proper bolt tension, that are thoroughly lubricated with RMC PLASTIC do not "freeze" but can expand and contract properly, so that rail-end batter is reduced and kinks and humps in track are avoided.

Let RMC PLASTIC help you prevent rail joint corrosion permanently with one simple application and prolong the service-life of rail, joint bars and fastenings.

You Can Get ALL You Want WHEN You Want It!

This illustration shows a splice removed 4 years after packing with R M C PLASTIC. Note that rail, joint bar, bolts and nuts are completely free from corrosion.

RAILWAY MAINTENANCE CORP.
PITTSBURGH, PENNSYLVANIA



Switch TO THESE SAFE, MORE VERSATILE "OFF TRACK" OUTFITS

Eliminate interference with traffic . . . speed up train schedules . . . cut your cost.

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Handles a multitude of jobs! This powerful 2-cycle Diesel tractor and 2-wheel scraper digs, loads and rear-dumps material . . . puts it where you want it . . . on the level, up a slope or around a bridge or culvert. One of the fastest outfits you've ever seen! Ideal for long or short hauls.

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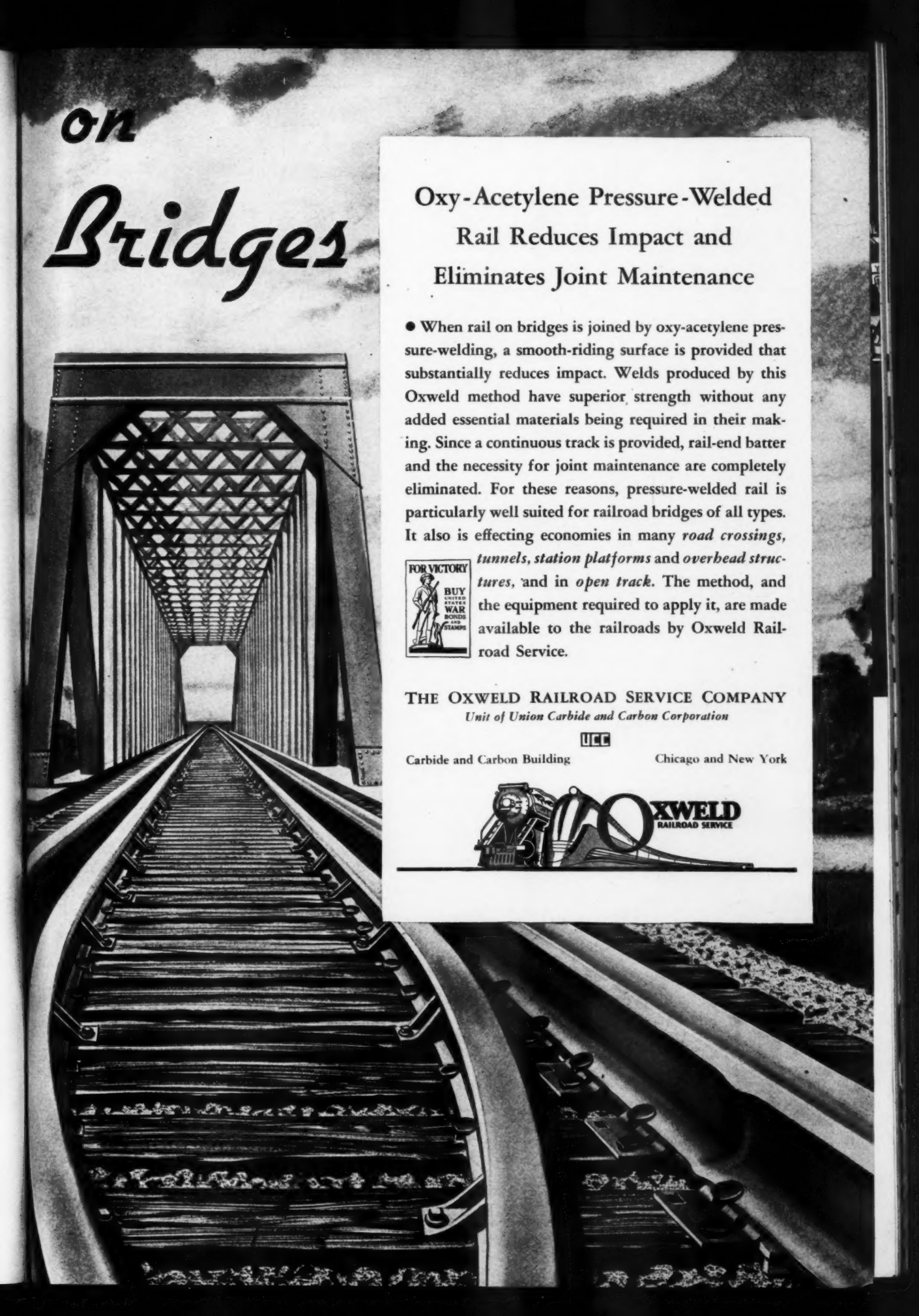

Oxy-Acetylene Pressure-Welded Rail Reduces Impact and Eliminates Joint Maintenance

● When rail on bridges is joined by oxy-acetylene pressure-welding, a smooth-riding surface is provided that substantially reduces impact. Welds produced by this Oxweld method have superior strength without any added essential materials being required in their making. Since a continuous track is provided, rail-end batter and the necessity for joint maintenance are completely eliminated. For these reasons, pressure-welded rail is particularly well suited for railroad bridges of all types. It also is effecting economies in many *road crossings, tunnels, station platforms* and *overhead structures,* and in *open track.* The method, and the equipment required to apply it, are made available to the railroads by Oxweld Railroad Service.

THE OXWELD RAILROAD SERVICE COMPANY
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DEPENDABLE, EFFICIENT DUFF•NORTON JACKS

No. 117
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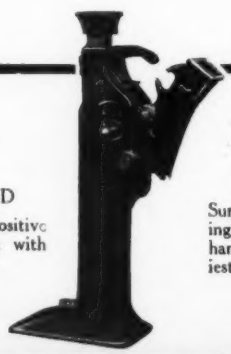
This Side-Lift Jack is a handy tool.



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No. 170 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Recording History

February 1, 1943

Dear Reader:

I wonder how many of you have had occasion, as I have had on several occasions recently, to review the measures that railway maintenance of way men resorted to in order to carry on in the face of acute shortages of materials and of labor during World War I. If you have faced this problem, where did you turn for information? From inquiries that come to us daily, I can guess where you went for I know where I turned. I went to the only places that I know where such information was made a matter of record—namely, to the back issues of Railway Engineering and Maintenance and of its parent magazine, the Railway Age. If you went there, and I assume that you did, I am sure that you found much information regarding the practices of that day, as I did, that was of interest and help.

This brings before us a function of a magazine like Railway Engineering and Maintenance that is frequently overlooked—that of building up a continuing record of the progress of its industry from month to month. By describing new practices and new equipment, by discussing trends, by editorializing on the problems that are most prominently in the thinking of the leaders of the day, a magazine not only informs its readers currently of the discoveries of others and thereby hastens their universal acceptance but also creates a continuing record that becomes increasingly valuable with the years. It is for this reason that so many of you bind or otherwise retain your copies of Railway Engineering and Maintenance in permanent form.

These are momentous days. The railways are making history. And nowhere within this industry are developments occurring more rapidly than in maintenance of way and structures. Many new trails are being blazed, new experiments tried. And while telling all of you what individuals among you are discovering here and there, we are writing the history of this era in railway maintenance that those who follow may read and proceed to build therefrom on still higher ground. This is a function of a business magazine. Have you ever thought of this phase of our service to you?

Yours sincerely,

Elmer T. Howson
Editor

ETH:GP

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D.C.
1081 National Press Bldg.

SEATTLE
1038 Henry Bldg.

SAN FRANCISCO
300 Montgomery St.

LOS ANGELES
Union Bank Bldg.

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Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3, 2 years $5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

PRINTED IN U.S.A.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

FEBRUARY, 1943

Railway Engineering and Maintenance

Every Time the Clock Ticks

The Tax Collector Takes $34

As a people we are rapidly becoming tax conscious. We will become even more so as we prepare our income tax returns. Only as we do this will the mounting cost of this war be brought home. No railway employee who works with any degree of regularity will escape. Yet even he may not realize the large part that the railway industry as a whole, entirely apart from the payments made by employees individually, is taking in the support of government. The figures that follow are illuminating.

Let us look first at the over-all figure. In 1942, the total tax accruals of the railways reached the colossal figure of $1,076,000,000. They crossed the billion dollar line for the first time. In the one year they rose more than $500,000,000, or from $547,230,000 in 1941 and from an all-time record prior to that year of $396,683,000 in 1929. This staggering increase in 1942 came from greater employment and higher wages, leading to an increase in payroll taxes, an increase in taxable net income, and much higher income taxes in 1942.

15.4 Cents from Every Dollar

These taxes took 15.4 cents from every dollar of operating revenues received by the railways. In 1941, they took 10.2 cents; in 1926-29 only 6.1 to 6.4 cents. In other words, the tax collector took more than one of every seven dollars that shippers and passengers paid the railways last year—and his was a prior claim; only six years ago, he took only one of every fifteen dollars. Measured in another way, the railways paid the tax collector 37 cents for every dollar they paid their employees in wages; their tax payments averaged $1,102 per employee.

And the employees fared better than the owners, for the railways paid 82 cents in taxes for every dollar they retained as net operating revenues—while the money paid for taxes exceeded the net income (after paying fixed and contingent charges) by more than $280,000,000.

A Return from Private Enterprise

This is the contribution that the railways, as an industry, are making to the support of the government and its war effort. It is a contribution which is exceeded by few industries. And it is not amiss to point out that it is income which would not be available if the advocates of government ownership had their way. Furthermore, it accrues to the government without offsetting subsidies for terminal or roadway facilities, channel maintenance, beacon lighting or other expenditures incurred for aid to competing forms of transportation whose returns in taxes are in no way comparable in magnitude with those of the railways.

The railways are rendering a service in national defense that is second only to that of our armed forces today; the railways are, in fact, a very essential arm of our military agencies. Their service to these agencies is winning universal commendation. And in addition, they have contributed this vast sum in taxes.

Railway taxes accumulated in 1942 at the rate of $2,948,000 every day in the year, Sundays and holidays included. They accrued to the amount of $122,833 every hour, day and night. Every minute of the year, the railroad tax obligation amounted to more than $2,000 ($2,047 to be exact). And every time the clock ticked the tax man took $34.

Derailments—

Must Take Measures To Prevent

NEVER in the history of the railways has rail been subjected to such intensive use as at present. Never has there been more urgent need for large replacemnt programs to offset the wear and other forms of deterioration that inevitably result from this intensive use. For more than a decade, the replacement of rail lagged well behind normal requirements, yet at present, despite the record-breaking and ever increasing traffic, in consequence of the restrictions that are being imposed on the purchase of new rail, on the basis of gross-ton miles handled and of passenger miles, the rate of replacement is still well below the subnormal renewals that were made during the period of greatly reduced traffic at the depth of the depression.

As every maintenance officer knows, rail wear is in direct ratio to the volume of traffic passing over it. They are equally aware, also, that the passage of traffic creates other forms of deterioration that may be as serious in their consequences as excessive wear. Owing to the subnormal renewals of rail since 1929, the average age of the rail now in service is greater than for many years. During this long period of service, wheel loads have increased well beyond those for which much of the existing rail was designed, so that much of the older rail is being overstressed with the passage of every train.

Furthermore, in addition to many of the sections being too light to conform to today's requirements, most of this older rail was manufactured under conditions that were favorable to the later development of transverse fissures, a hidden defect which frequently makes its presence known only when it causes a disastrous derailment. It appears in the form of a progressive fracture, the development of which is related to the volume of traffic carried by the rail.

Obviously, in view of the restrictions that are being imposed on the purchase of new rail, it is not possible at present to renew any considerable amount of this older rail, or even that part of it that is most open to suspicion. Yet a number of serious derailments have occurred recently as a result of transverse fissures in old and relatively light sections of rail in important main lines. Generally, derailments caused by transverse fissures are serious, and some of these derailments reach the magnitude of disasters.

One of the most disturbing features of the present situation with respect to transverse fissures is that they are increasing at a somewhat accelerating rate. Although some increase might be expected by reason of the large volume of traffic now moving and of the increasing age of the rail, the number appears to be out of proportion to what ought to be expected from these causes.

Fortunately, maintenance officers have available a method for detecting the presence of transverse fissures in rails in service long before they manifest themselves in broken rails. Unfortunately, however, all roads are not availing themselves of the facilities to do this, at least as often as they should, for in several of the recent derailments caused by transverse fissures, a detector car had not been operated for some time over the section of track involved; in fact, for a period long enough to permit the inception and growth of the fissures that caused the rails to break.

This is a matter that should be given more thoughtful consideration than it seems to have received in some quarters. Obviously, safety should ever be uppermost in the mind of every officer who is even remotely engaged in railway operation. No one can successfully build a defense out of excuses, particularly if the action, or lack of action that is being defended has resulted from indifference, neglect or even lack of appreciation of ones responsibilities. Every railway officer should be alert to the danger that exists potentially in these older rail sections, and some of the latter ones as well. He should be able to say with informed knowledge, that his rail is free from the affliction of transverse fissures because inspection has been thorough and frequent enough to assure that newly developed transverse fissures are detected before they become dangerous.

Planning—

Essential Now for the Work Ahead

While still maintaining one eye on the weather to guard against the possible disruption of traffic by further cold spells or snow storms, maintenance of way supervisory officers, down to and including foremen, should now be looking to the months of active work ahead with a seriousness beyond that of many previous years. Unlike the situation that prevailed during the recent depression, when maintenance men looked forward to curtailed programs, with stable forces from an abundant labor supply, these men now face a season of maximum effort, while confronted with shortages in essential materials and equipment on every hand, and a shortage in experienced maintenance labor, and, in fact, in any class of labor, unlike anything since the boom days of the late Twenties. In fact, they face these conditions under traffic demands which are larger and more pressing than at any previous time in history.

Under circumstances such as these, maximum efficient results are not achieved for the asking. Neither are they achieved by normal effort and planning. They are gained only by weeks of unusually careful thought and planning by every supervisory officer in the organization, in the light of the part he must play, whether it be large or small—in the office or in the field, to insure, as far as possible, that every hour of labor and every pound of material will be used most effectively.

In the face of the difficulties and uncertainties that lie ahead, the problems of planning maintenance work accurately in advance are greatly multiplied. Thought will be wasted, mistakes will be made, alterations will be required. Scarcity in one class of materials or another, the necessity to await the availability of proper work equipment, shortages in labor, and any one of a number of other factors may call for adjustments in the most carefully laid plans. But that is little excuse for lack of advance thought and planning on the basis of the most likely conditions that will prevail, with consideration to the difficulties that are certain to arise, many of which are predictable as accurately as the basic considerations.

What maintenance man of experience waits to prepare for winter conditions until a heavy storm is upon him? It is equally demonstrable that only careful planning and preparation on the part of the entire maintenance of way organization can prepare its property and key its forces to the uncertain tasks that lie ahead this year. Valuable time will be lost if constructive planning of the work of the coming spring and summer awaits their arrival. And this applies not alone to the work of the general office. It applies equally to the work of the district and division office, and that of the roadmaster, the supervisor and the foreman as well.

Trenching—

Is It Necessary During the Winter?

IN MOST sections of the country January and February are the months of heaviest snowfall, and this continuing accumulation of new snow, added to that already on the ground, may present a potential problem in drainage. Furthermore, the accumulation of snow alongside tracks may be increased considerably as a result of successive passages of snow plows and other snow-fighting equipment. The question then arises whether it is desirable to keep the ditches through cuts open to insure quick disposal of the water resulting from thaws.

In general, sections that commonly have heavy snowfall also have their share of severely cold weather. In these sections thawing temperatures are rarely very high or long-continued during January and until late in February or early in March. In almost all cases any moderation of the weather sufficient to cause thawing is followed shortly by a cold wave of sufficient intensity to cause freezing. If, therefore, the ditches have been opened, the water they carry will be exposed to freezing and will create a barrier to the runoff from later thaws, the water from which may overflow onto the track, creating conditions far from desirable, if not actually dangerous. On the other hand, if trenches have not been opened, the water that results from thawing will seep slowly through the snow, eventually reaching the side ditches, which, if they have been cleaned properly in preparation for winter, will provide a channel through which the water will find its way out of the cut without overflowing onto the track.

Unless the temperature rises to an exceptional level, resulting in complete saturation of the snow because thawing occurs faster than water can percolate through it, the water from the melting snow will find its way into the ditches and will eventually create an underground channel to the outlet. Snow seldom freezes far below the surface, for which reason, even during a severe cold wave, when thawing is interrupted the water will continue to seep through the snow until it has drained away. Under these conditions it is desirable to keep the covered channel and allow it to function as needed.

Although the construction of open trenches in the snow during the winter season does not seem advisable generally, as spring approaches, with the prospect that the temperature will rise to a level where thawing will occur rapidly, all outlets should be opened to dispose of the water as quickly as possible. At this season the ground is usually somewhat unstable as a result of frost action and standing water in the vicinity of the roadbed may be highly detrimental to the track.

Razed Buildings—

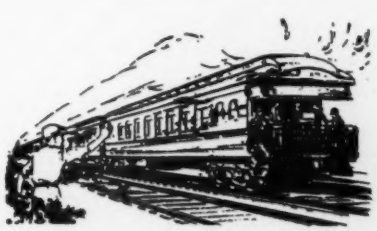
Be Sure to Get Maximum Salvage

DESPITE the campaigns that have been conducted by many roads, continuously or intermittently, during the last decade to get rid of unused buildings and others that, although being put to some use, were not strictly necessary, a surprising number of buildings still remain that can be disposed of without detriment to today's operations. Few of these buildings are modern; some of them are obsolete because they are not adapted to today's requirements, while others are obsolete because the need for which they were built has passed; and still others are no longer necessary because of changing conditions.

All of these buildings contain materials that can be salvaged and reused, some of them in considerable quantities. Not a few contain critical materials or items that can be used as substitutes for critical materials. For this reason, in these days of restrictions on purchases of materials that are vital to railway maintenance as well as to military operations, it should be worth while to keep a continual check on the need for maintaining structures that are now of little importance.

Close supervision should be given to the removal of these structures to insure the salvage of every item of recoverable material. Too often, the wrecking of railway buildings has been attended by an almost complete loss of easily-recoverable materials. Such waste has always been inexcusable; it cannot be tolerated today. Not a few items, including plumbing, lighting and heating equipment and fixtures, may be obsolete, measured by modern designs, but still usable or in such condition that they can be repaired and reused. Doors, windows, frames, interior finish, siding and structural members should also be removed with the care necessary to obtain the maximum possible salvage from them.

If one has never taken a building down in this manner, he will be astonished at the amount and variety of the materials recovered. He will be equally astonished later to learn the multitude of applications he will have for them when demands arise that cannot be filled in the usual routine from new stocks or by merely filling out a requisition. This may be a new experience, but the present inability to obtain many of the items that are urgently needed will create a new respect for the value of used materials, even among those who have been in the habit of saving and reapplying them; those who have not done so will learn some useful lessons.



Revamps Bridge Practices . . To Cope With

This Through Truss Span Carries the B. & M. Across the Merrimack River at Hooksett, N.H.

R. N. Brodie

EARLY in 1942 the steel-repair problem had reached a critical stage on the Boston & Maine. Attributable to a variety of factors, chief among which were conditions brought about by the war, this situation had been developing for some time. For the last 10 or 12 years, the B & M. has followed the practice of having the major part of its maintenance steel repairs performed by contract. These contracts were of two main types. In one of them, the contract was for the steel only, fabricated and delivered at the site, while in the other type the contract covered the completed job, including fabrication and erection. In the first case, the material was erected by the railroad's steel gangs.

Changing Conditions

During the period from 1931 to 1938, the competitive situation in this field of contracting, especially as to welded work, was highly favorable, and the contract system was justified economically. Toward the end of this period, however, bid prices began to indicate a rising trend. Another development having a bearing on the situation was the inauguration of the national defense program following the outbreak of war in Europe.

As the demands of the war industries increased, fewer and fewer bidders could be interested in the work offered, and steeply rising prices began to reflect the preference of the available contractors for easier and more lucrative defense work. This, combined with rapidly shrinking supplies of materials, compelled the railroad to give consideration to the problem of correcting the situation. With this end in view, T. G. Sughrue, chief engineer, appointed a committee to make a thorough study of the problem, with the idea of determining what remedies were possible.

At the time that the committee commenced work on its assignment, the Boston & Maine was already well embarked on a large-scale scrap-recovery program, and, in addition, had, for many years, been exploring the possibilities of salvage and reclamation in many branches of the service. It was one of the functions of the committee to extend this policy into the field of structural steel repairs. Three major subjects were investigated, namely, (1) expansion of the railroad's repair crews to replace contractors that were no longer available; (2) establishment of facilities for fabricating steel; and (3) the use of salvaged steel for maintenance repairs.

After about three months' study and some experimentation, the committee reported on these items thus: (1) To keep pace with the increasing demands of war-time traffic, the steel repair crews should be expanded as rapidly as the labor and equipment problems could be overcome; (2) the railroad should use its own mechanical shops for the fabrication of structural steel used for repairs as well as other purposes; and (3) it is feasible to use salvaged steel for making repairs, and about 80 per cent of the company's requirements could be satisfied in this way as long as second-hand material could be made available.

Practices on Other Roads

As a preliminary step, a survey was made of the current practices and preferences of the industry by means of a questionnaire circulated among a number of representative roads. Prompt responses were received, containing much useful data, from which some interesting conclusions were derived. The results of this poll are presented here for whatever interest they may have for those concerned with bridge maintenance. Of those replying to the questionnaire, 77 per cent believe that all maintenance repairs should be done by railroad forces; 23 per cent believe that all or part of this work should be done by outside contractors; 16 per cent think that only large welding jobs, of definite extent, should be done under contract; 85 per cent combine welded and riveted repairs in varying proportions; and 87 per cent of those who make welded repairs operate their own welding crews, all capable of working separately or in combination with riveting crews.

Regarding fabrication, 62 per cent of those replying believe that all work of this type should be contracted if possible; 17 per cent contract large

Wartime Shortages

By R. N. Brodie*

Chief Draftsman,
Boston & Maine, Boston, Mass.

Materials for Victory

No. 8 of a Series

To meet the problems of bridge maintenance under present-day conditions, calling for the exercise of the greatest skill and ingenuity, the Boston & Maine appointed a committee to study these problems and to recommend solutions. As a result of its studies, a revised course of procedure was adopted, which includes (1) expansion of the repair forces to handle work formerly done by contractors, (2) use of the company's shops for fabricating steel, and (3) the extensive use of reclaimed steel

work only; 30 per cent have all or part of their fabricating work done in their own mechanical shops; and 8 per cent operate their own fabricating shops exclusively for repairs. As to the relative economy of these policies, 54 per cent believe that repairs can be done most economically by railroad forces; 30 per cent believe that the cost of work done by company forces is equal to that of contract work; and 16 per cent believe that contract work is cheaper. In commenting on the question of economy, 85 per cent thought that factors other than cost were of equal or even greater importance. Their reasoning is that complete control of the forces is necessary to meet traffic and safety requirements, and to permit efficient planning and co-ordination of effort. Several mentioned the advantages of having railroad repair crews available for emergencies.

As to the effect of the war, 40 per cent had made no changes in their procedure (July, 1942). The remainder had made, or would soon make, various adjustments, such as the deferment of work, and the use of substitutes or second-hand steel. While the users of reclaimed steel are, at present, in the minority, others expect to be compelled to try it soon. Obviously all will be faced with this problem sooner or later, depending on the size of their reserve stocks and developments in the priority and allocation policies of the government. Since, under war conditions, some of the data collected by means of the questionnaire were of only academic interest, the committee went on to develop methods of carrying out its emergency recommendations.

The proposed expansion of our steel-repair crews was faced with two main obstacles, namely, the shortage of labor, especially of skilled welders, and the difficulty of obtaining the necessary equipment, such as welding machines, without excessive delay. At this writing, however, it is expected that equipment can be obtained and assembled within a reasonable time. The acute lack of qualified welders and steel workers is still to be overcome, although a definite plan for solving this problem has been developed.

The needs of steel-repair work are such that specialists are not as useful as all-around bridgemen. It is proposed, therefore, to find some suitable candidates among present employees, and to train them as bridgemen in both welding and riveting crafts. In this way it is hoped that some labor difficulties will be avoided, and that the crews will not be subject to frequent disruption due to the demands for skilled labor in other fields.

Since the expected source of a large proportion of the repair material needed is the company's reclamation plant at Billerica, Mass., and as the largest units of the stores and mechanical departments are at the same place, efficiency and convenience dictated the choice of this location for the work of fabrication. In performing this work, the second-hand steel, after selection and inspection as described elsewhere in this article, is moved from the reclamation plant to the locomotive shop on small push cars, or on regular

*Mr. Brodie is also chairman of the Boston & Maine Committe on Steel Repairs.

The B. & M. Has Many Steel Bridges To Maintain. This Is a Structure Across the Connecticut River at E. Northfield, Mass.

cars if the size requires them. The work to be done is outlined briefly in shop orders of the same type as those used for mechanical work. These are issued by the purchasing and stores department on requisition by the engineer maintenance of way. Detail plans for the work accompany both requisitions and orders.

During the progress of fabrication, the work is subjected to the same shop inspection as would be the case if it were done by outside contractors. This part of the procedure is under the direction of the engineer of structures. While the quality of the finished work is naturally determined to some extent by the available material, it has been found practicable to adhere to a standard that is very little lower than that required on new material.

Although the needs of structural fabrication presented some new problems to the mechanical shop forces, they took on the work with energy and enthusiasm, and have displayed notable resourcefulness in making the necessary adaptations. So far, the greater part of the needs of ordinary repairs and strengthening have been filled satisfactorily.

The scrap shipments received at Billerica are derived from collections made all over the system, and from the abandonment of unused structures. On arrival, the material is sorted into three categories as follows: (1) That which can be used as received; (2) that which can be reclaimed; and (3) that which should be scrapped at once. In many cases the choice is difficult and narrow, and involves the consideration of alternatives of a vital and urgent nature. To maintain the railroad, a maximum of material must be retained for re-use. On the other hand, the largest possible quantity of scrap must be sent to the mills. All possible sources of metal are being combed, and a constant effort is made to meet these requirements.

In addition to the handling of assorted scrap shipments, the plant also dismantles whole structures and pieces of retired rolling equipment. Recently, some I-beams were recovered from a crane frame and used in a bridge, and some channels from a rail motor car went into a coaling plant.

To insure as far as possible that material will be available when needed, without inter-departmental competition, a system of earmarking metal for special uses has been adopted. Sometimes material is thus reserved before structures are dismantled, but the practice of tying up material for other than definite purposes is discouraged.

One fruitful source of repair material was a number of bridge spans which were not in use due to track abandonments or other operational changes, but which had been left in place. These are now being removed and carefully dismantled, sometimes at considerable expense, in such a manner as to yield the largest amounts of scrap and usable material. Other bridges which had been held in storage with a view to possible re-erection as units are being subjected to the same process. In this way the scrap situation is benefited and the drain on new material supplies is eased.

The relative difficulty and expense of working over old material discourages its use in normal times. Apart from conditions brought about by the war, a considerable amount of salvage and re-use has always been practiced by this and other railroads. This has proved to be economical and practicable in the case of whole units, such as bridges and other items, which might be more properly described as having been transferred to other service rather than salvaged. Whatever the relative economy may be now, the downright necessities of the war program compel the use of reclaimed material to the fullest possible extent.

The adaptation of reclaimed steel to the uses of maintenance repairs often requires considerable ingenuity, and a careful check of all parts of the structure which may be affected by a change in detail. It is seldom that steel is recovered entirely free from unwanted holes, but frequently only one leg of an angle, for instance, will have been punched, leaving the other clear for new connections. It is often possible to use existing holes, but if the original net section cannot be restored, each job must be considered on the basis of net improvement over previous conditions. Unwanted holes can also be plug-welded and new ones drilled where needed.

By the use of such expedients as the redesign of details, the addition of fillers, and planing or grinding, corroded sections may be replaced by others of different thicknesses. In many instances conditions will permit a fairly wide choice of replacement sections without harm to the structure. Under today's conditions any device for making repairs is justified if it helps to carry the load, and this means that some structural conventions must be shelved for the duration.

Design Procedure

In adapting reclaimed material for further use, a certain amount of extra work is required on the repair plans, in addition to the necessary detailing for fabrication in railroad shops. The design of steel repairs is now handled in the following manner:

1. The inspection of the structure is made in the usual way, not only to determine what repairs are required, but, of greater importance, to decide what cannot possibly be deferred. Office computations of reduced sections assist in arriving at this conclusion.

2. The repair plan is then developed to the point where a bill of materials can be made. Extra columns are provided in the bill for field checking and notes on substitutions which may become necessary. (If the job is a simple one and stocks of material are known to be adequate, the plan can be completed and forwarded at this stage.) Fluctuations in the salvage situation make it rather difficult to keep track of stocks, and generally plans are handled as next described.

3. The plan is sent to the reclamation plant to see if the required material can be found. If the bill can be filled as written, the necessary material is earmarked and set aside.

4. Next, the material is inspected and checked for size and condition and, after any necessary adjustments have been made, is ready to send to the shop. If the bill cannot be filled, the draftsman who made the plan goes to the reclamation plant and makes whatever substitutions are practicable. The principal pitfall at this point is the possibility that existing details will interfere with substitutions, and this must be checked carefully. If there is no available substitute for the member in question, other schemes of repair are considered, such as adding material by welding, and a great deal of trouble can often be avoided in this way.

5. The plan is revised and completed on the new basis, and is then forwarded to the purchasing department with a requisition for the work.

It is necessary, of course, to insure that any second-hand material used in stress-carrying members is in good condition, and it is inspected carefully for concealed defects. This procedure involves a certain amount of extra work that new material would not require, but it is justified by the results.

At present the best available material is being used first. In time it may become necessary to replace corroded sections with material somewhat reduced in section but better than that replaced. When this stage is reached, repairs will have to be made, not on a restoration basis, but with a view to achieving a temporary net benefit to the structure. Needless to say, the Boston & Maine has adopted a rigid policy of restricting steel repairs to those vitally necessary to maintain traffic for the duration.

It is believed that the procedures described have helped to overcome a serious emergency, and are of immediate benefit to the war effort.

Annual Track Awards Made by C. & O. and N. & W.

AMONG the railroads that continued the practice during 1942 of conducting annual track inspections for the purpose of making awards for excellence in track maintenance were the Chesapeake & Ohio and the Norfolk & Western. Both of these companies have conducted annual track inspections for many years and have followed the practice of awarding cash prizes each year in the interest of promoting interest in excellence of track maintenance among section foremen and supervisors. These roads have announced the results of last year's inspections, and these are given in the following.

Chesapeake & Ohio

It is the practice on the C. & O. to make its annual track awards largely on the basis of records made by a special roadway inspection car. In the past it has been the custom to operate the car over the system three times during the year, and, in connection with one of the trips, to incorporate the car in a special train carrying general and local officers interested in the condition of the properties. Track inspection awards were made on the basis of results obtained by combining the records obtained during the three trips of the inspection car. Because of wartime conditions, the operation of the special train was dispensed with in 1942, and necessary data for making the track awards was obtained by attaching the inspection car to regular trains, the car being operated over the system in this manner in March and again in July.

To the end that the different territories may be judged on a comparative basis, they are divided into five groups according to the character of the track and the class of traffic handled. These groupings are made on the following basis: Group 1—double-track main lines, freight and passenger traffic; Group 2—single and double-track main lines, principally freight traffic; Group 3—single-track main lines, principally passenger traffic; Group 4—secondary branch lines; and Group 5—yard and terminal territories. Lines in Group 4 were not inspected in 1942.

In Groups 1 and 2 prizes of $50, $40 and $30 were awarded to the supervisors in each group who received the first, second and third highest ratings, respectively, while in Groups 3 and 5, prizes of $50 and $40 were awarded to the supervisors having the first and second highest ratings, respectively, in each group. In addition, a prize of $50 was awarded to each of two supervisors—one in Groups 1 and 2 and the other in Groups 3 and 5—whose territories evidenced the greatest improvement during the year. Awards to foremen consisted of cash

A Section of Heavy-Duty Double-Track Main Line on the C. & O., Which is Typical of Much of the Mileage Rated High in the 1942 Inspections

prizes of $25 and $15 for the best and second-best maintained sections in each supervisor's territory. The winning supervisors are as follows:

Group 1 — First prize — C. E. Butcher, Cincinnati district, Cincinnati division; Second prize—W. P. Nichols, Ohio River district, Cincinnati division; Third prize—J. H. Poindexter, Peninsula district, Richmond division.

Group 2 — First prize — H. S. Chandler, Rivanna district, Richmond division; Second prize—J. F. Painter, James River district, Clifton Forge division; Third prize—O. C. Ewers, Paintsville district, Ashland division.

Group 3—First prize—G. E. Bostic, Mountain district, Clifton Forge division; Second prize—Charles Hetisimer, Miami district, Chicago division.

Group 5—First prize—F. P. Barrick (assistant division engineer), Russell division; Second prize—L. H. Lucas, Maumee district, Hocking division.

C. E. Butcher, first prize winner in Group 1, was also awarded the improvement prize for Groups 1 and 2, and W. E. Amburgey, supervisor, Lexington district, Ashland division, was awarded the improvement prize for Groups 3 and 5.

Norfolk & Western

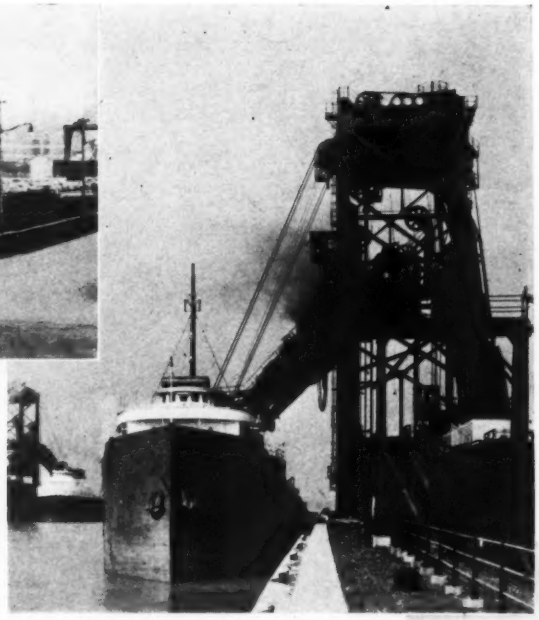
As a result of the annual track inspection on the N. & W., it was found that the average system track rating —9.40—was equal to that attained in 1941, the highest in the history of the railroad. This compares with a rating of 9.38 recorded in 1940, the previous high. The rating of 9.50 is the highest that can be given. The average of the individual ratings earned by the section foremen was even higher than in 1941, being 9.435, as compared with 9.430.

With a rating of 9.44, the Shenandoah division held first place among the company's five divisions, while the Norfolk terminal, also having an average rating of 9.44, was judged the best-maintained terminal on the road. This was the same rating given the Norfolk terminal in the previous year, when it also held first place among terminals. Among the roadmasters' territories, four districts were tied for the highest rating, which was 9.45. These were districts No. 3, Church Road, Va., to Phoebe; No. 6, Hagerstown, Md., to Island Ford. Va.; No. 7, Island Ford to Roanoke, Va.; and No. 19, Greggs Hill, Ohio, to Columbus.

Following its usual practice, the railroad awarded cash prizes to the track foremen whose territories held first, second, third and fourth places on the different districts. Such prizes were awarded to 81 track foremen, including 21 first prizes, 24 second prizes and 18 prizes each for third and fourth places.

Although none of the track foremen received the all-time high rating of 9.50 (won by Ernal McCann, Sardinia, Ohio, in 1941), three foremen succeeded in attaining the rating of 9.49. These were: E. P. Wootten, Ford, Va.; F. W. Camden, Glasgow, Va.; and W. V. Crosby, Lockbourne, Ohio. The greatest improvement among track foremen's territories was achieved by those of J. F. Woodall, Durham, N. C., and A. C. Eddins, Willardsville, N. C., whose 1942 ratings were both 14 points better than in the previous year.

Must Protect Railway Structures



"In Our Field, the Objectives of the Enemy Include Railway Bridges, Freight Depots, Docks, Power Plants, Interlocking Plants and Freight Classification Yards; in Fact, Anywhere Where Large Quantities of Rolling Stock and Lading Are Concentrated"

B. R. Kulp

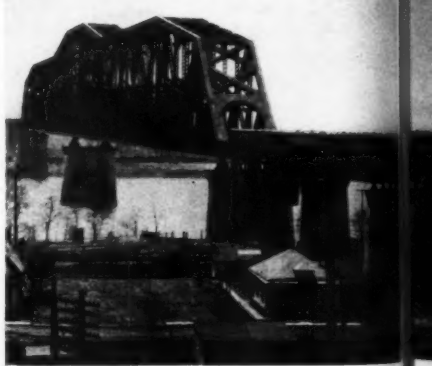
THE protection of railway structures is an important matter at any time, but particularly so in time of war. The transporting of men and materials is largely dependent on the railroads, and to keep their lines open for operation is one of your jobs as bridge and building men. To do this is no simple task, and in time of war it is doubly difficult. Even though you have the assistance of federal, state and civic bureaus, together with that of other departments of your own roads, in this work, much of the responsibility rests on you. You are the ones who will have to explain why this or that could have happened.

Communications Vital

All military tactics and strategy are based on the maintenance of communications. Armies whose communications are cut or interrupted seriously are in a hopeless position. The maintenance of communications is so far-reaching as to include the source of supply and the means of transportation to the ultimate theatres of action. In a war economy, the transportation of troops and war materials is just as important to victory as the successful field operations of the armed forces. To assure this continuous movement of men and material, the nation looks to us to do our part.

The greatest threat to this uninterrupted service is sabotage. Since the end of World War I, the people of the United States have almost forgotten the dread implications of this word. Again, however, we are faced with the fact that sabotage is a serious threat to our war efforts. I have no desire to stir up hysteria on this subject, but we must look at it in a calm, business-like way, realize the existence of this potential menace, and be prepared to detect, combat and frustrate it.

America's experience during World War I proves that we have many vulnerable targets for those intent on sabotage. In our field, the objectives of the enemy include railway bridges, freight depots, docks, power plants, interlocking plants and freight classification yards; in fact, anywhere where large quantities of rolling stock and lading are concentrated.



From the activities of the Federal Bureau of Investigation, it is reasonable to assume that our enemies are well established in this country for carrying on subversive activities, using every opportunity to disrupt production and transportation. *They must not be underrated.* They employ intelligent technique and ingenuity in their methods, and are daring beyond question. Examples of this

Against SABOTAGE

An address presented before the forty-ninth annual meeting of the American Railway Bridge and Building Association, in Chicago on October 20, in which the speaker warns bridge and building men of the dangers of subversive activities, tells them of methods of protection being employed, and places on their shoulders much of the responsibility for protecting and keeping railways open

By B. R. Kulp,

Chief Engineer,
Chicago & North Western, Chicago

were publicized recently in the newspapers when enemy agents were landed from submarines. They were equipped with destructive materials and plans for the destruction or disruption of specific plants and structures of great importance.

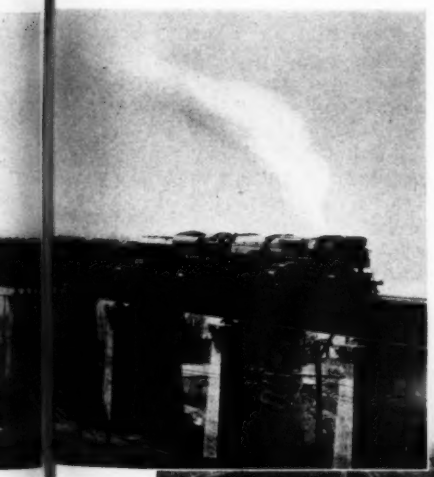
Major Protective Measures

The major protective measures that can and are being employed are as follows:

(1) Investigation and identification of employees by badge and photograph, together with the filling out of questionnaire forms and the taking of fingerprint records on F.B.I. forms, including a small-size front view photograph. Copies of these fingerprint records are filed with the F.B.I. at Washington, D.C. This procedure is used only at certain important locations, such as docks, terminals, etc. The questionnaire form used is comprehensive in scope and provides an excellent history record of an employee and his relatives. The forms are carefully reviewed and filed for reference. Only authorized persons are permitted access to these records.

With regard to the identification of employees, some railroads are requiring all employees on their properties to wear badges, on which are printed small-size photographs of the holders. Authorized visitors are also required to wear badges while on the properties.

(2) The erection of high wire fencing, where practical, to enclose vulnerable areas, confining the entrances, where possible, to one common gate, where a guard (in most cases armed and deputized) is on continuous duty with authority to admit no one unless properly identified, and to open and examine all packages. A gate shanty is provided, with telephone service for liaison and reporting purposes. Wherever such gate controls are maintained, a log record is kept of all persons entering or leaving, other than employees.



(3) Floodlighting, where practical and necessary, is used as an effective means to discourage and control trespassing, and to assist guards and watchmen in the performance of their duties. This form of protection, however, requires careful consideration and study before employment, since in some cases it can attract and emphasize the importance of a structure. Some of the benefits of this type of protection include the blinding effect on trespassers, the exposure of anyone entering the lighted area, and the ability of guards to remain concealed. Power houses and outside power and lighting transformer banks are extremely vulnerable and important to the continuous operation of plants and terminal facilities, and should be given special consideration.

(4) The use of armed and deputized guards, or watchmen, roundsmen and roving agents, at vulnerable areas and at important bridges, other structures and terminals. All guards, roundsmen, watchmen and employees on duty at important bridges and other structures are drilled and instructed in the control of unauthorized persons entering the property, and in the prevention and fighting of fires. All suspicious persons or equipment on or adjoining railway property are immediately reported to special agents for investigation.

Foot patrol roundsmen, covering specific areas on regular rounds, are usually supervised by the recording of their trips at clock key stations located at established places throughout the area or property being patrolled. In most cases guards, roundsmen and special agents are

(Continued on page 111)

Must Reduce Use of Cars and

"Shippers and Receivers Are Being Importuned to Load and Unload Cars More Promptly — Railroad Men Have an Even Greater Responsibility."

No Cars For Storage Purposes*

By W. C. Kendall

Chairman, Car Service Division
Association of American Railroads
Washington, D.C.

WE on the railroads have a common problem before us, and you in the maintenance of way department are in a position to be most helpful in solving many of the difficulties arising in the use and handling of freight cars in this somewhat critical period. The railroads are faced with a rising tide of traffic, and without the increase in cars and locomotives which, a year ago, they had anticipated would be available. As a result, they must do even more to increase their efficiency in order to take up the slack with what they have. There must, inevitably, be still greater efficiency in the use of cars now owned if the job ahead is to be done.

Shippers and receivers are being importuned to load and unload cars more promptly, and to give each car a full load. Railroad men have an even greater responsibility, for they should set an example for others in getting the most out of each unit of transportation. You men and your subordinates are concerned directly with the use of cars handling company material, other than locomotive fuel. All company material, such as ties, rail, angle bars, sand and ballast, is susceptible to unnecessary delay in unloading, due, no doubt, to habit born of the thought that this is company property in company cars, and that whether the cars are released promptly does not matter particularly. This attitude must be overcome, and maintenance officers are in a strong position to be of positive help by initiating and promoting a campaign against car storage, one of the present evils contributing to lost or wasted car-days.

*Abstract of an address presented before the annual meeting of the Roadmasters' and Maintenance of Way Association in Chicago on September 16, 1942.

Fewer Cars and Locomotives

Let us examine the railroad plants briefly. The present railroad car ownership totals about 1,737,000 units and about 42,000 locomotives. This is 600,000 fewer cars and about 20,000 fewer locomotives than were owned in the late twenties. A year ago it was expected that the railroads would acquire about 120,000 new cars in time for the peak traffic of 1942. For the first seven months of 1942, 51,000 new cars and 432 new locomotives were added to the railroads' ownership, with 36,000 cars and nearly 900 locomotives on order. It is doubtful if these orders will be filled by January 1 next; in fact, it is generally conceded that they will not. It is now estimated that a minimum of 80,000 new cars should be made available before the season of peak traffic load of 1943, if the anticipated transportation load of that period is to be handled satisfactorily. It should here be added that the railroads are currently making new records for keeping their equipment in serviceable condition. As of the latest date available, the percentage of cars awaiting repairs was 3.1 per cent, a new low, as compared with a normal figure of 6 per cent.

Peak Traffic

During the first eight months of 1942, the railroads handled 31 per cent more ton-miles than during the corresponding period of 1941. The previous period of peak traffic load was in 1929, and yet the ton-miles so far in 1942 are 43 per cent ahead of those of that year. They are 67 per cent greater than they were during the earlier war year of 1918.

Many changes have taken place in the channels of freight movement in the present war year of 1942, which make it different than any previous year in railroad history. Our country is fighting a two-ocean war; indeed, one which stretches across seven oceans. In addition, with the loss of coastwise and intercoastal shipping facilities, the railroads must now provide a greater amount of transcontinental service than ever before. With the stoppage of tanker service, petroleum and petroleum products are now moving by rail from the South and West into the Eastern Atlantic states at the rate of about 830,000 barrels a day, as compared with a movement of about 11,000 barrels a day a year ago. The longer hauls and heavier loadings caused by these and other factors account largely for the large increase in ton-miles which is being handled currently and efficiently.

(Continued on page 108)

Locomotives

In Company Services

Chairman and District Manager of the Car Service Division, AAR, tell of dire need of the railways for power and equipment, especially flat and open-top cars, to meet war demands; cite unwarranted delays in the unloading of cars, and urge maintenance men to match the record of co-operation set by shippers

The Need for Motive Power Is as Great or Greater Than the Need for Cars and Should Be Used Only When Absolutely Necessary

You Can Help Tremendously*

By W. D. Beck

District Manager, Car Service Division, Association of American Railroads
Chicago, Ill.

TODAY, the railroads are facing, as they have been facing for some time, the greatest and most critical carloadings in history, and while thus far the task has been met with flying colors and we have transported everything required in the order of men and materials, there is much anxiety as to the future.

While railroads have on order 80,000 cars and 900 locomotives, it is doubtful if we will be allocated the necessary steel and other materials for their construction, and we anticipate the necessity for continuing for a long time without an increase in these badly needed facilities. Therefore, it is particularly essential that we make the most intensive and effective use of the equipment that we have. You must help in reducing the use of cars and locomotives in company services, and the real target at which it is desired that you shoot is the magnificent record of co-operation on the part of shippers and receivers, not only as concerns heavier loading, but especially their efforts in the rapid loading and unloading of cars. As a result of this co-operation, the total number of cars awaiting release by our patrons, as compared with the total on hand to unload, is running somewhere in the neighborhood of 15 or 16 per cent—a miraculous situation when compared with the record of earlier years.

In this district, we have 65 so-called "Vigilance" chairmen, who represent the shipping and receiving public in their particular communities. These men, with our assistance, have taken it upon themselves to insist that the receivers of freight release cars the first day, if at all possible, and the second day in any event. You will understand what a material help these committees have been in securing the prompt release of cars and in having them ready for the next shipper.

I know whereof I speak with respect to the number of gondolas, hopper and flat cars tied up with company material, and in many instances unnecessarily, because the use of these cars might have been avoided if those responsible for their use had ordered box cars, stock cars or work cars instead, for your materials. We cannot escape the fact that practically 95 per cent of our war equipment is being shipped in open-top cars, and certainly everybody knows, or should know, that not a single hour's delay must be permitted in the movement of this war impedimenta. You are, therefore, urged with all the energy at my command, to discontinue using open-top cars for any of your materials unless they are of such nature as will absolutely prohibit loading in any other type of car.

Emphasizing the delays to which railroad equipment is being subjected, I quote some totals from the Car Service division's report of September 1. No doubt you will be alarmed to observe the car-days delay reflected therein. As to cars of coal and coke on hand for all companies, the number of days supply runs all the way from 1 to 20; yet we are firmly of the belief that many roads could get along with five day's supply; indeed, in some areas close to coal mines, they could get along with three. Therefore, we ask that you scan this particular item as it pertains to your own railroad and bring about an improvement. The average day's detention for other company material runs from one to eight days per car. Indeed, in one instance it runs to 10 days, and in another to 30, which we believe you know is entirely out of line with requirements and good railroading.

The total number of cars of com-

*Abstract of an address presented before the annual meeting of the American Railway Bridge and Building Association in Chicago on October 22.

pany material on hand for all the railroads in the United States as of the particular date under consideration adds up to 53,700 cars, or almost 4 per cent of the entire car ownership. We maintain, and believe that you will agree, that this is much more than should be permitted.

In many instances we have found that your purchasing departments are ordering supplies loaded on your own cars, and that they have also insisted that certain materials, perfectly capable of being loaded into box or stock cars, be loaded in open tops. It goes without saying that you men have had something to do with such insistence, because we know, of course, that it is much easier for you to unload angle bars, spikes, drawbars, chains, and many other such materials from open-top cars and flat cars than it is from box cars. Purchasing departments should immediately discontinue ordering the use of their own equipment for the duration, because this requires too much switching and other delay. They must also discontinue ordering open-top cars.

It is also well known to you that we are far from being well supplied with motive power. Therefore, let me urge you briefly, and yet with earnestness, that whenever materials are capable of being released from cars without the use of locomotives, it should be done. We should never ask for a locomotive unless there is sufficient material to be moved to warrant the ordering of a work train for a full day, and should conform ourselves to the use of way freights and other local service whenever possible, even though to do so may require some overtime. We have it on the best authority that there will be a traffic rise of somewhere around 10 to 15 per cent in 1943; thus, every locomotive capable of pulling a train, and every freight car, must be conserved. You can help tremendously in this effort, if you will.

No Cars for Storage Purposes

(Continued from page 106)

Mention should also be made of the increasing volume of transportation required by the military in the movement of personnel and impedimenta. According to a recent release by the War department, a total of 6,500,000 men were moved during the first eight months of 1942, which is more than three times the number moved during the corresponding period of the first World War. And the materials and weapons of the present war are of a different type than those of 25 years ago, and require a greater amount of transportation. For example, the Car Service division is frequently called upon to assemble from 1,000 to 1,500 open-top cars for immediate service to move military divisions half way across the country. It is these movements, superimposed upon those of construction materials necessary to various government projects, which have strained the open-top car supply, making it appear that a shortage of this type of equipment may be "just around the corner." To avert such a situation, it will be necessary for all of us to eliminate all waste of car-days and avoid the use of this type of equipment.

I doubt if many in the maintenance of way department appreciate fully the extent to which cars are being detained under load with company material. The figures following refer solely to revenue cars under load with material other than locomotive fuel. No attempt has been made to separate the cars by types, but it is reasonable to assume that a substantial proportion of them are of the open-top type, such as are needed most urgently now for the transportation of essential war materials.

As of a recent date, one road in the West reported 1,221 cars of company material on hand an average of 6 days; another Western road, 610 cars for an average of 10.4 days. A road located nearby, and not of large mileage, reported 80 cars on hand an average of 5.8 days; another large road in the West, 597 cars an average of 5.9 days. A road in the South reported 61 cars on hand an average of 12 days, while an Eastern road—not a large one—reported 230 cars on hand an average of 6 days.

Not all roads have records like these. One of the largest roads of the country reported 1,535 cars on hand an average of 1.8 days; another, 624 cars an average of 2.6 days; and still another, 264 cars an average of 1 day. There are many roads in the West and the South which are reporting an average detention of less than 3 days.

The particular point in the presentation of these examples is to show that there appears to be no necessity for any road holding revenue cars under load any longer than the free time given customarily to the receivers of carload traffic before demurrage begins. I am sure that if those in the maintenance of way department were held responsible for delays on a demurrage basis, there would be few payments of $5.50 a day for car detention.

"There Appears to Be No Necessity for Any Road Holding Revenue Cars Under Load Longer Than the Free Time Given Receivers of Carload Traffic"

Need Gondolas Especially

I have referred in particular to the seriousness of the gondola situation because this situation is accentuated by the comparatively low ownership of this class of equipment by those roads serving the Western, Southwestern and Southern areas of the country, areas where so many government projects, such as air bases, are under construction. The loading of sand, gravel and other construction materials in these areas is proceeding at a pace never before contemplated. It is inevitable, therefore, that the roads serving these areas must use cars of other ownership to make up for their own deficiencies, especially since they have had neither time nor the opportunity to

(Continued on page 113)

Our Responsibility As Track Men in Wartime

By F. R. Layng

Chief Engineer, Bessemer & Lake Erie
Greenville, Pa.

INSTEAD of stressing our responsibilities or duties with relation to the war effort, I am going to take another view of our relationship to this effort and emphasize the fact that this is a great opportunity for us to render invaluable service, not only to our respective companies, but also to our country in this time of crisis.

The present war is being conducted differently in most respects from any previous conflict. Heretofore war has been carried on to a large extent by the armed forces of the countries involved, and the civil populations have been affected only incidentally. At present there has been adopted a phrase that well expresses this difference, namely, "All-Out War." Just what does this mean? This means that every man and woman, whether actually in uniform or not, is an essential part of the war effort. Our part is just as important as that on the firing line. Never before has the part of the war effort that falls to the civil workers been so essential, so imperative, as at present. For these reasons, you men with your special training have an opportunity such as you have never had before, to render service—more important to my mind than if you were in combat service.

War of Transportation

This has been called a war of steel and no one would suggest that steel is not one of the most important materials necessary to win the war, but in a very real sense this is a war of transportation. Of the four major methods of transportation, rail, water, highway and air, rail is by far the most widely used. Railroad transportation stands supreme in its ability to operate 24 hours a day, seven days a week and 12 months a year, with marvelous efficiency, flexibility and dependability. Fortunately, the railways have built up a transportation machine that reaches every section of this continent. It has been so designed that it has the ability to meet variations in volume of traffic and to adjust itself to changing conditions. This is not so with other forms of transportation.

You are all aware of the important place that the facilities under your care occupy in the operation of our railroads. Those facilities are the foundation on which the entire railroad plant rests. Any failure in them results in delay, loss and sometimes disaster. If they are not maintained properly, there is a definite loss of efficiency in the operating department. Proper track maintenance is absolutely essential to the prompt, uninterrupted and safe movement of traffic. It is for these reasons that I do not hesitate to emphasize the importance and value of the work in your charge, and to assert that you can contribute more to the war effort in your own field than if you were in the armed forces.

What Is Ahead?

What is ahead of us? Certainly a greatly increased volume of traffic. One estimate made recently is that the ton-miles of freight to be carried next year will exceed those of 1942 by 15 per cent, and that there will be a continuing increase in passenger traffic. Undoubtedly we will see continued progress in the more efficient loading of cars and in the speeding up of trains all along the line. For some time to come we will not be furnished the materials and labor necessary to maintain our present facilities to the standards to which we have been accustomed, and it seems certain that relatively small additions can or will be made to our present facilities. In other words, the railroads will have to do the job with what they now have. We will have to conserve what we have to the fullest extent, reconditioning worn facilities to the limit, and devising new methods to extend the life and usefulness of every part of the railroad plant.

In our particular field—the track department—we have already felt the shortage of labor and materials, and I would not be true to what I sincerely believe if I did not emphasize that in this regard the immediate future not only holds no relief, but promises continued and increasing shortage. Therefore, there is every reason why we should redouble our efforts to conserve what we now have, and bend our thoughts to greater accomplishments along these lines than we have ever dreamed of doing.

Much has been accomplished; the track departments of all of our railroads have performed miracles in carrying successfully the heavy additional loads that have been imposed in the last two years. But if I interpret the immediate future correctly, this means that we will have to do much more. It is futile to spend time wishing for the things we cannot have. The only thing to do is to keep clearly in our minds the facts as I have outlined them, and then for each of us to face the future with a firm determination to do our full part in developing ways and means to carry on. I know of no cun-

A Southbound Train on the B. & L. E.

ningly devised methods that can be employed. Probably Winston Churchill's warning of "blood, sweat and tears" is what we need. I believe, however, there are a few things we can keep in mind that will help. They are—

Keep fit. Make every effort to keep yourself in the best possible physicial condition.

Spend as much time on the road as possible. Let others do the paper work. Inspection and more inspection is demanded. How much better to detect and correct improper track conditions before an accident occurs. In either case, they must be fixed, so take care of them now—not later.

Do not wish for what you cannot have of materials and men. Make the most of what you have.

Be patient—be cheerful—be careful.

Set an example of industry to those under you.

Be thankful that you have such an important place in this great undertaking.

And this brings me to the thought expressed at the outset—what a great opportunity we have to exercise those qualities which railroad men have always possessed in good measure—courage, resourcefulness, ingenuity. In this we will be encouraged and sustained by the knowledge that our cause is just, that we have been attacked by the most cruel, heartless and Godless set of men the world has ever seen in power and that we must win. We will also be spurred on to do our utmost as our patriotic duty to our country and by our faith in the American way of life, which we know is the best way. I am sure each of us is ready to dedicate all that he has to serve his country, to help conquer the enemy, and to preserve our way of life.

Spot Surfacing Track*

By J. B. Kelly,
General Roadmaster,
Minneapolis, St. Paul & Sault Ste. Marie
Stevens Point, Wis.

THE most effective, economical, satisfactory, permanent and progressive method for spot surfacing track is the troweling method. It is effective because the tie bed is not disturbed, for the ballast material is added without tamping, and it thus avoids the necessity for breaking through the accumulated tie bed. It is economical because from five to ten times as much track can be restored as by the conventional hand or machine system of tamping. I recall an outstanding instance that illustrates this:

A roadmaster, who was meeting opposition in his effort to establish this method, assembled 12 men for one day. He assigned 2 men to determine by sight and level, and to mark, the amount of ballast to be placed under the ends of each tie; 2 men with trowels to place the ballast; 2 men with jacks to raise the track; 4 men to dig out the ends of the ties; and 2 men to dress the ballast. Six men worked on each side of the track. At the close of an eight-hour day, this gang had spotted two miles of track, on which the work was considered heavy for this class of surfacing. Generally only about one-half of this output could have been expected.

Troweling is satisfactory, because its results extend far into the necessary maintenance of joint fastenings, rail ends, ties and tie plates, since much better opportunity is given for avoiding low joints, which contribute so largely to rough, choppy riding, and which, in turn, bend the bars and wear the fishing surfaces and eventually wear and batter the rail ends.

It is permanent, because the settlement of track surfaced by the troweling method is almost negligible, since the old bed has not been disturbed by churning shovel blades or the impact of tamping bars, tamping picks or mechanical tampers. After trowel tamping has been followed consistently for a year or two, a marked improvement is evident in the track surface. It is progressive, because each day's work leads to a higher standard of maintenance.

Dependence on the trowel has become so marked on this road that two are furnished to each section, one for emergency or for those cases where two crews are organized. There are exceptions, but ordinarily track will not be maintained free from irregularities in surface for any considerable time without spotting. Damage will often be done unless the method employed is decisively fast; otherwise only a part of the mileage is likely to receive attention during the season or the period allotted to this work.

How It Is Done

Almost all maintenance men are more or less familiar with the method followed in troweling track, and know that it requires considerable supervision and application to insure its effectiveness, and this has been one of the reasons for the lack of interest they have taken in it. For the benefit of those who are becoming more interested, I shall outline the trowel method for spotting track.

A good tamping trowel consists of a spring—steel blade, 5½ in. by 36 in. by ⅛ in., secured to a track-shovel handle at one end by riveting. With a little practice, one should be able soon to judge the amount of ballast to place on the blade for various lifts. The material is placed under the ends of the ties and for a distance of about 15 in. inside the rail.

The foreman, with a track level, or with one man and a track level, marks the track for troweling. Ordinarily the rail with the best surface is chosen for sighting, the level being used on the opposite rail. The amount of lift required to surface and the level variations, must be marked on the outsides of the rail head above each tie with chalk, lumber crayon or soapstone, the sign—to mean ⅛ in., 1 to mean ½ in., 11 to mean ½ in., etc. The marking is important and should never be omitted. Enough track should be marked up for at least a half-day's surfacing. While sighting and marking, an X indication should be marked on the outside of the rail base to indicate where the jack holes are to be dug.

Any other men in the gang are to follow the foreman, clearing the ballast from the ends of the ties that are marked, to the level of the bottom of the ties, leaving the ballast bunched conveniently for loading on the trowel. As they progress, the jack holes are also dug to the bottom of the ties, so that the pressure on the foot of the jack will not force material from the crib under adjacent ties.

When the marking has been completed, the foreman and one man, with the trowel and the jack, go back

*This discussion was submitted for presentation in What's the Answer department in response to a question as to the most effective method for spot surfacing track. Because of its comprehensive character, it was withheld for publication here as an independent article. For further discussion of this subject, see page 625 of the September issue.

and start lifting. This time the track should be raised from 1 to 1½ in. without sighting, and the material placed under the ties from the ends, with the trowel, in the amounts called for by the marks. To do this the trowel is loaded by pulling it back and sidewise into the ballast. It is then slipped, loaded, under the tie cautiously and jerked quickly from under the load. Care must be exercised to prevent skidding the ballast too far toward the center of the tie, and equal care is required to insure a uniform load of proper depth on the trowel.

As soon as the men engaged in digging out the ends of the ties and the jack holes finish their work, they should go back and dress the ballast behind the surfacing. If the track is very rough or the weather is hot, one side may be spotted first and the other side brought up the next day.

Can Also Surface This Way

In some districts the maintenance organizations have not only acquired proficiency in spot troweling, but have gone into general surfacing with the trowel, with splendid results. In this case the foremen use some additional equipment, such as a short spot board, two sighting blocks, and two step blocks, graduated by quarter inches to a total height of about five inches. The lift at half-rail points is determined first by sighting to the spot board and by the reading of the level board, and is indicated by chalk marks on the side of the head of the rail. After this, a sight is taken along the rail head and the rail is marked for the intermediate troweling before proceeding with the marking of the succeeding half-rail lengths, in every case showing the amount of ballast to be put under each tie. Where coarse ballast is in use, arrangements are made to provide a quantity of aggregate of suitable size for troweling.

Those who attended the annual meeting of the Roadmasters' Association in 1938 will recall the statement of W. K. Wallace, chief engineer of the London, Midland & Scottish railway of England that on his road, after rail is relaid, the track is given a light lift, and then is maintained by shovel packing (troweling) until the next rail renewal, sometimes for as long as 20 years. The density of traffic on some lines is so great that the intervals between trains is only 10 to 15 minutes, so that there is no time to surface in the way it is usually done in this country. The success of the method is attested by the fact that trains are operated at speeds ranging from 60 to 114 miles an hour.

Mr. Wallace's address contained many surprises, not the least of which was his statement that for three years his road had followed the practice of measured shovel packing, in which the material on the trowel is calculated carefully, and that with this method the track remains in surface from 50 to 100 per cent longer than with ordinary troweling.

Must Protect Against Sabotage

(Continued from page 105)

under the jurisdiction of the chief special agent, who provides the essential contacts for co-operation with municipal, state and federal police and intelligence services.

Fire Hazard

Because of the combustible composition or content of many structures, fire is the principal hazard. Such structures should be studied carefully and suitable fire extinguishing equipment and other appropriate fire-fighting apparatus should be provided. This equipment should be inspected frequently against tampering and to insure proper maintenance, so that it will be ready for immediate use in an emergency. Vegetation, rubbish and inflammable waste or scrap material should never be permitted to accumulate on or adjacent to combustible structures. A high standard of housekeeping should be maintained in and around structures at all times. This will minimize the normal fire hazard and chances of fire by acts of sabotage.

All recommendations of the various fire prevention services for the improvement of protection and the elimination of hazards should be carefully considered and checked with the thought of providing the maximum of protection and minimum of hazard. Fire drills should be conducted periodically. Water mains, valves, pumps and other protection equipment should be tested frequently, and all authorized persons should be thoroughly instructed in their use to avoid confusion and delay during an emergency.

Fire prevention and protection activities on the railways are under the jurisdiction of the chief fire inspector, who maintains the essential contacts for co-operation with municipal, state and national fire associations and services, and who also collaborates with the chief special agent's department where interest is joint. Wherever explosives are stored or used, special locks should be provided for doors, and one man should be held responsible for the distribution of the explosive and for the control of the keys to the facility.

Care should be exercised in the distribution of switch and master keys, and a careful record should be kept of those to whom keys have been issued. Men leaving the service should be required to turn in any such keys, together with their identification badges. Extreme care should be exercised in the distribution of drawings, blueprints, correspondence or information which could in any way help the enemy. In this regard, blueprints, drawings or maps of underground water mains, control valves, electrical conduits, etc., are of unusual importance. Information pertaining to train movements, class of equipment, tonnages and types of lading being handled, or troops carried, should never be disclosed or discussed unless necessary, and then only with authorized persons.

In some instances, governmental organizations will undertake the protection of certain essential structures or facilities, but only after private industry has been unable to cope with the situation adequately.

Report Sabotage Attempts Promptly

The F.B.I. is very co-operative and has aided our road greatly with suggestions on our protection problems. Its forces are trained to investigate sabotage or attempts at such. It is important, therefore, that you see that your personnel reports to you promptly any attempt at sabotage, or any irregularity which may indicate such an attempt, regardless of how small. You, in turn, should lose no time in relaying these reports, with all details and the results of your investigation, to your superior officer, so that he can bring them to the attention of the F.B.I.

In closing, permit me to stress the importance of unending vigilance at all times, and that employees should not hesitate to question or to report the presence of strangers encountered on railroad property. Vigilance in time of war is a definite duty of all railway employees. It is particularly the duty of you engineers and bridge and building supervisory officers, as in the carrying out of your duties in the field you are in a position to notice irregularities or places where acts of sabotage could be attempted. Then too, you are charged with the employment of greater ingenuity and alertness in the protection of strategic and vital structures. And remember, the same alertness and enthusiasm you expect in your men must be ever evident in yourself, or you will fail to inspire them.

How Missouri Pacific Developed Reflex Signs

FOR the last ten years, the Missouri Pacific, in common with a number of other roads, has been using reflector buttons as a substitute for lamps, to give certain indications to trains approaching restricted sections of track. Also, in common with practically all of the other roads, the first efforts of this road to install the reflex units gave results that, to say the least, were not satisfactory. Being convinced, however, that the idea back of the reflex units was sound basically and of sufficient merit to warrant study, the engineering officers undertook to develop designs that are now giving the desired results. The steps by which the final conclusions were reached are of interest.

It should be emphasized that the studies leading up to the designs now employed by this road were not made formally, but were carried out by means of field experiments and observation. As a result of these studies, however, reflex units are now being used as standard practice on certain fixed signs, including yard-limit boards, stop and caution signs and temporary slow signs. The units in use on these signs are octagonal in shape, 7½ in. in diameter, and are primarily markers for the purpose of calling attention to the location of the signs.

Did Not Indicate Clearly

Similar units were tried out as markers for permanent speed-restriction signs, but were unsatisfactory for the reason that, while they did call attention to the signs, they did not assist in making the figures on the signs more readable. Experiments were then undertaken with reflex-illuminated figures, using a 6-in. block figure, corresponding to those that were painted on the sign. This proved to be equally unsatisfactory for, while the figures were distinct, they were not readable for a sufficient distance to enable the engineman on a fast-moving train to observe the indicated speed clearly. During the early experiments the markers contained 25 reflex buttons, ⅞ in. in diameter, spaced approximately uniformly over the area of the 7½-in. disc, while those in the illuminated figures were 11/16 in.

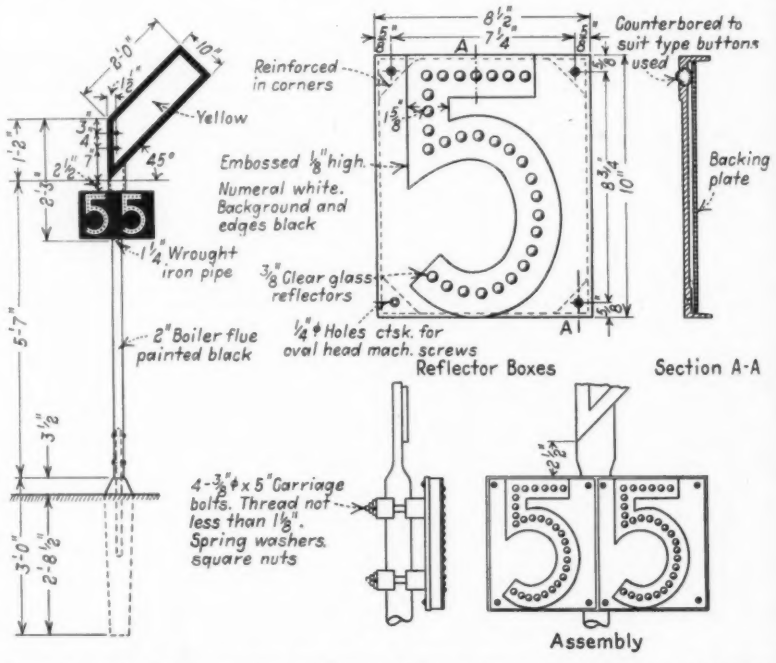
At this time it was not understood that the size of the buttons might make considerable difference in the effectiveness of the mass reflection from the sign. For this reason, as well as because the reflecting figures had been a failure, while the octagonal markers appeared to be satisfactory, experiments were started to determine whether the shape and size of the characters made any difference. In the first place, it was discovered that when the figures were of the ordinary block type, considerable difficulty was experienced in distinguishing between certain of them. Through a series of trials and eliminations it was found that by changing the forms of the characters, that is, by giving them flowing lines, this trouble was overcome and they became much more readable.

Made Numerals Larger

Originally, the speed restriction figures were placed on the banner of the sign, but the largest character that this banner could accommodate was one having a height of 6 in. It soon became apparent that this was too small to be read easily at the necessary distance and, co-incident with the change in the style of the characters, they were increased to a height of 10 in. But, since this was too large to be placed on the banner, they were placed on a separate board, which is mounted on the standard of the sign, immediately below the banner.

Made Buttons Smaller

While this was a decided improvement, even these changes left something to be desired, and the reason was sought. Up to this point the buttons on the markers had been ⅞ in. in diameter and those in the figures had been 11/16 in., on the theory that the larger the reflecting surface, the better the reflection would be. Only a little observation was needed to show that this was a fallacy for it was seen that on a figure having a width of stroke of 1⅝ in., the halo from the buttons tended to distort the shape of the figure. Then, observation of a number of commercial signs, in which letters or figures were illuminated with reflector buttons, showed quite conclusively that smaller buttons, ⅜ in. in diameter, had two distinct advantages over the ones in use, in that they outlined the character more distinctly for the night indication and, during daylight they obscured the painted figures less. On the basis of these observations, ⅜-in. buttons were adopted and this has resulted in a



Speed Restriction Sign, Showing Details of Reflector Boxes and Assembly of Numerals

further and generally satisfactory improvement.

Co-incident with this phase of the investigation, the spacing of the buttons came up for consideration. Tests made several years ago by the signal section of the Association of American Railroads developed the fact that, for the best indication, the spacing of the buttons, center to center, should not be greater than twice the diameter of the buttons. Although these tests were made with buttons more than ½ in. in diameter, the rule seemed to apply with equal force to smaller buttons, and this spacing was adopted as the maximum for the ⅜-in. buttons. Obviously, this size and spacing require a larger number of buttons for each character, and thus increases the cost, but the officers of the Missouri Pacific are convinced that this additional cost is more than offset by the improvement in the indication.

Banner Painted Yellow

Being in the nature of a caution indication, the banner of the speed restriction sign is painted signal yellow. It was believed at first that the background of the board carrying the figures should also be of this color, and that the figures should be black. However, this combination did not give a good indication either day or night. By day, the white (crystal) buttons tended to obscure the black figures, while at night, the yellow background blended so with the reflected light that the figures did not stand out clearly.

Tests of a number of color combinations showed that by making the background black and the numbers white, a greatly improved indication was obtained. There seemed to be no good reason for using yellow on the number board, since the banner of the sign gave the caution indication by both shape and color, while the figures were added only as supplementary information.

While the studies that have been described were made in connection with the development of permanent speed-restriction signs, and the conclusions were applied specifically to them, the same considerations that were raised in the studies are applicable to any case where characters, whether figures or letters, are to be illuminated, unless conditions require that the characters must be given a specific color.

These developments have been made under the direction of A. A. Miller, chief engineer maintenance of way of the Missouri Pacific to whom we are indebted for the information appearing above.

No Cars for Storage Purposes

(Continued from page 108)

obtain new cars from the builders.

The extent to which these "borrowed" open-top cars are dislocated is illustrated by the fact that the number of open-tops in service on Western roads increased about 20,000 during the first eight months of 1942. This increase has been at the expense of the owners of the equipment, on whose roads it is now badly needed to provide for current shipments of steel products and those other materials for which this type of car was initially provided.

It will be helpful toward a better understanding of the opportunity for those in the maintenance of way department to assist in this program of conserving car-days to present a few examples of mishandling of equipment as revealed by checks made recently on various railroads throughout the country by the field force of the Car Service division. The cars referred to in these instances were all good-order, open-top revenue cars, and generally gondolas with either solid or drop ends, both of which types are in great demand.

Flat Cars, Too, Are in Great Demand for Military Shipments

On one road, a car of trash was held under load for 16 days; a car of scrap for 29 days; several cars of ties for more than 5 days; 17 foreign cars of tie plates and angle bars for 6 days; 3 empy cars for loading sand, 15 days each; 3 cars of sand awaiting movement, 19 days each; 7 cars of ties for 5 to 10 days, awaiting unloading or other disposition. On another road, three 65-ft. foreign-owned gondolas were found to have been held under load with tie plates for 3 weeks, and then moved in a direction away from the owning road. On this same road, several 65-ft. foreign gondolas were held under load with piling for 6 and 7 days. Another road held 6 gondolas under load with cinders from 9 to 21 days; 17 cars, principally foreign, under load with scrap, for 4 to 11 days; and 10 cars, principally foreign, under load with company sand, for 4 to 6 days.

The Car Service division is now carrying on a campaign on all of the railroads of the country, bringing such instances of car delays to the attention of the managements to the end that corrective action will be taken. You men in the maintenance of way department will contribute largely to the war effort if you will so supervise the handling of company materials on your respective roads as to avoid car delays of the character to which I have referred.

Perhaps I can close my remarks in no more appropriate and effective way than to repeat some of the suggestions made recently by the vice-president of operation of the A.A.R. in a circular letter to the chief operating officers of all roads, with regard to the more efficient handling of company material.

Company material (other than company fuel) at destination, must be placed promptly and unloaded within 24 hours after arrival.

All departments receiving company materials should furnish yard masters with placement orders for the cars in advance of their receipt, to enable them to classify and place the cars without unnecessary switching and detention at destination.

Empty cars for the loading of company material should not be ordered until the materials are ready for shipment. Billing should be furnished promptly to avoid delay and unnecessary switching.

Do not use cars for the accumulation of scrap. Bins and storage space should be provided for that purpose.

In closing, I solicit your assistance in making every car perform the work for which it was intended, and not to use cars for storage purposes.

New Book

Railway Engineering and Maintenance Cyclopedia

EDITED by Elmer T. Howson, editor, *Railway Engineering and Maintenance* and western editor, *Railway Age*, and C. Miles Burpee, managing editor, formerly research engineer, The Delaware & Hudson R. R. Corp., assisted by Herbert R. Clarke, chief engineer, Burlington Lines (Track Section); John B. Hunley, engineer of structures, New York Central System, Lines West of Buffalo (Bridge Section); Arthur L. Sparks, architect, Missouri-Kansas-Texas Lines (Building Section); Clarence R. Knowles, superintendent of water service, retired, Illinois Central System (Water Service Section); and Herbert G. Morgan, signal engineer, Illinois Central System (Signal Section). 1,224 pages, 2,500 illustrations. 8 in. by 11½ in. Bound in maroon fabrikoid. Published by the Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago. Price $5.

The 1942 edition of the Railway Engineering and Maintenance Cyclopedia is the fifth issue of a work which for more than twenty years has been accepted and approved as the outstanding guide to efficient mainteance of way and structures practices. Completely revised and rewritten by railway men, in co-operation with the American Railway Engineering Association and the Signal section of the Association of American Railroads, this book deals authoritatively, thoroughly, and yet concisely, with all matters relating to railway engineering, maintenance of way and structures, and signaling and is essentially seven valuable books in one, including within its pages technical and practical data that are now available only in scores of books, and hundreds of magazines, reports and pamphlets. With 200 additional pages, 10 new chapters and new and revised data equivalent to 636 pages, enlarging its scope and thoroughness; profusely illustrated throughout with photographs, diagrams and tables, more than 1,250 of which are new; and with larger and more comprehensive indexes, the new volume marks a new high level in the series of Engineering and Maintenance of Way Cyclopedias produced by this publisher.

Specifically, the new edition includes descriptions of the latest developments in methods, materials, appliances, devices and work equipment now in use in the maintenance of way and structures field, which are closely co-ordinated with more than 250 manufacturer's pages, which are devoted to detailed descriptions and specifications of specific products. In fact, the entire book is arranged specifically to meet the exacting requirements of busy railway officers and the needs of their supervisory staffs.

Divided into eight sections comprising 99 chapters, the text has been assembled under their principal headings, in the respective divisions of track, bridges, buildings, water service and signaling. These technical discussions describe every phase of construction and maintenance procedure and are followed by a general section which includes discussions of materials, processes and equipment employed in more than one maintenance division. The definition section tersely defines more than 2,500 terms and expressions occurring in engineering and maintenance work and also serves as a general subject index. The final section comprises a directory of products, and indexes of trade names and manufacturers pages appearing in the volume, and serves as a complete cross-reference and a ready means of locating quickly, specific data relating to all products described and referred to in the Cyclopedia.

The new edition includes new chapters on Roadbed Stabilization, Tunnels, the Repair of Concrete Structures, Bridge and Building Tools, and Standardized Buildings. In keeping with recent developments, the chapters on Concrete Masonry, Stone Masonry and Its Maintenance, Building Insulation, Scales and Scale Test Cars, and Pumps have been entirely rewritten, while extensive revisions have been made in all other chapters to include the latest information on all materials, products and methods, including the latest wartime emergency specifications, as well as the standard specifications and recommendations of the A.R.E.A., the Signal section of the A.A.R., the A.W.P.A. and other prominent railway engineering societies.

What Our Readers Think

Getting Faster Delivery

To the Editor: Dallas, Texas.

I have read with much interest the answers to a question relating to faster delivery of water to locomotives, which appeared on page 909 of the December issue. It appears that all of these answers lean toward increasing the elevation of the storage supply to provide more rapid delivery, or toward relocating the tank to bring the supply nearer to the point of delivery. I believe that the solution lies in increasing the diameter of the delivery line, holding the tank elevation to the minimum.

My reason for this is that the diameter of the delivery line may be increased four inches, which will double the volume delivered, assuming that the present line is 10 in., at an increased cost of approximately $1.50 per ft. of line, with no material change in friction loss. Furthermore, to increase the elevation of the tank necessarily increases the production cost, since about ½ hp. will be required for each 100 gpm pumped to a height of 10 ft.

Another matter to be considered is the velocity that should be maintained at the column base. My experience is that the foot-pounds (weight times velocity) per second should approximate 3,500 because of the difficulty of holding the spout in the tank while taking water, when the foot pounds are increased above this figure.

R. L. Holmes,
Engineer Water Supply, Texas & Pacific

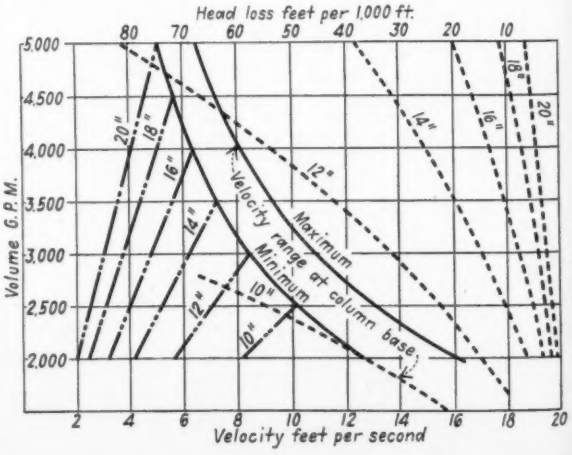


Diagram Showing Characteristics of Water Columns of Various Sizes

What's the ANSWER?

Cribbing for Retaining Walls

What substitutes can be used for metal and reinforced concrete cribbing units for retaining walls? What is their relative life? Their advantages? Their disadvantages?

Several Alternatives

By M. Hirschthal
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

With conservation of steel a prime consideration in all design work, it is essential that substitutes be found for metal and reinforced concrete cribbing for retaining embankments. For this purpose there are two types of substitutes, namely, plain concrete or a different material of construction. If the wall is to be temporary, say for only a few years, untreated timber, even used timber such as old ties, may be used. If it is to be a more-or-less permanent structure, treated timber should be used and the members should be preframed.

The front batter for a timber crib should be more pronounced than that used for concrete cribbing. The minimum batter should be three inches, but preferably four, to the foot. The width or depth should be at least 0.5 of the height, when located beyond the plane of distribution of engine loading and more nearly 0.6 of the height when closer to the track (13 ft. from the center line of the track is about the line of demarcation). Headers should be placed 5 ft. to 6 ft. center to center, and if the wall is of considerable length, a double line of headers should be used at intervals, as is the practice with concrete or metal cribbing. The section may be offset at the back where greater widths are required for high walls.

The alternative is to use gravity masonry walls, which may be either plain concrete, stone or rubble masonry. This will, of necessity require the installation of construction (contraction) joints at short intervals. The maximum distance between these joints should be 20 ft. for high walls and 10 ft. for low walls; probably the best rule for this is to make the spacing of these joints equal the height of the wall. Walls more than eight feet high should be analysed for the location of the resultant of the pressure and weight and the resulting toe pressure at both the top and bottom of the footing course, and especially for sliding.

Drainage should be provided to prevent the building up of hydrostatic pressure behind the walls as well as to prevent expansion and heaving of the backfilling in winter. It is good insurance to apply bituminous waterproofing to the back of the wall to prevent filtration of water through the wall, with its attendant evils.

Wood Most Plentiful

By G. L. Staley
Bridge Engineer, Missouri-Kansas-Texas, St. Louis, Mo.

Wood is about the only material, other than concrete and metal, that is available to any extent for use in crib retaining walls. Since the use of stress-grade timbers (some of those restrictions have been modified since this was written—Editor) is now restricted, the material that remains available is reduced to tie timber, poles, etc., which may still be cut to the sizes desired.

Crib walls of timber of various descriptions have been used for many years, and were used wherever the problem at hand seemed best solved by their use, even when there were no restrictions on any of the materials adapted for such work. If the design is what it should be, a timber-crib retaining wall will serve as well as

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in April

1. In view of the present difficulty of obtaining materials for track maintenance, to what extent should section forces sort and classify the scrap they collect and retain materials that can be reused? Who should be the judge of their usability?

2. As the supply of manila fibre is now shut off and sisal fibre is frozen, what substitutes are available? How can the rope now in service be made to last longer?

3. Where difficulty is experienced in obtaining new rail, should the old rail be surfaced out-of-face or maintained by spot surfacing until it can be renewed? Why? What considerations are involved?

4. In what new ways can power tools be used in bridge work to offset the present shortage in labor? What tools?

5. In view of the probability of an acute shortage in track labor this summer, is it now preferable to renew ties with section or extra gangs? Why? What are the advantages? The disadvantages?

6. To what extent, if any, can concrete and vitrified pipe be employed as substitutes for metal pipe in plumbing installations?

7. What special efforts should be made to conserve track tools and thus prevent waste of critical materials?

8. How can the use of critical materials be avoided in the construction of walls and partitions? Are there advantages? Disadvantages?

any other. The life of the wall will be whatever the life of the timber is, however, and may be made comparable with that of reinforced concrete, or, say, 35 years or more, by preservative treatment.

The ability of a timber-crib wall to absorb settlement with little or no damage and the ease with which the units can be handled, resulting in fast construction, are advantages. One of the disadvantages is the fact that woods of the species available in this country are not so indestructible as concrete and metal, no matter how treated. It should be kept in mind, however, that concrete in crib walls is not so permanent as concrete when used for other purposes. The permanence of metal cribbing is, like that of wood, dependent on the kind of metal used and the protection against corrosion afforded it.

Lists Several Substitutes

By Julius M. Bischoff
Office Engineer, Terminal Railroad Association, St. Louis, Mo.

Restrictions in the use of metal and reinforced concrete cribbing bring to mind several substitutes which are available, and which are listed in the order of preferential use, together with the advantages and disadvantages.

1. Heavier sections of plain concrete cribbing units. The advantages are the elimination of steel and the readily available supply of concrete. The disadvantages are the heavier units and the liability of breakage.

2. Plain concrete walls of gravity section. The advantage is the same as in (1); the disadvantage is greater cost.

3. Rubble or cut stone laid in cement mortar. The advantages are that the stone is usually available locally and there is little likelihood of priority restrictions. The disadvantage is the lack of skilled masons to lay up the retaining wall.

4. Granite paving blocks laid in cement mortar. The advantage is that these blocks are readily available in municipalities where the old paving is being taken up and replaced, usually with concrete or asphalt paving. The disadvantage, as in (3), is the lack of skilled masons, but in this case a reasonably satisfactory job can be obtained with semi-skilled labor, with proper supervision.

5. Second-hand timber, such as old crossties, switch ties, bridge ties, timber stringers, and other trestle timbers. The advantage is that a supply of these materials is always on hand. The disadvantages are short life and costly replacement. These materials should be used only for temporary work or in emergencies.

Suggests Round Cedar Logs

By H. M. Tremaine
District Engineer, Northern Pacific, Spokane, Wash.

In my experience, a very satisfactory substitute for metal and reinforced concrete cribbing units has been found in round cedar logs, which might be called oversize, that is, which are larger than the ordinary specification requirements for piles or poles. When ordered, if it is specified that the material be oversize and of random lengths, frequently an unsalable stock may be obtained at low cost.

The life of such a crib wall is somewhat indeterminate, but I believe that it can be regarded as being about 25 years. The cedar logs should be placed in lengths as long as possible, for this not only adds to the stability of the construction, but allows bridging over weak spots in the foundation, which are likely to be present.

Another thing which the use of these logs seems to permit is more hasty construction and, if necessary, the tamping of the backfill may be omitted with confidence. Of course, I realize that all cribs, when filled, should be tamped, but in the emergency which sometimes requires the installation of such cribs, the tamping may be omitted without taking too much of a chance. I have used such installations many times, and as yet have found no unfavorable features.

Women in Maintenance Work

For what kinds of work can women be employed in the maintenance of way department to offset the present labor shortage? To what extent?

Has Employed Women

By Bernard Blum
Chief Engineer, Northern Pacific, St. Paul, Minn.

We have employed three or four women on one of our sections in the state of Washington, but even in these mechanized days track maintenance is difficult for women, except for those who are very strong and hardy, to continue it day after day. I do not believe that it is practicable to employ women in the bridge and building department, as these crews are not normally stationed at one place, and for obvious reasons it would hardly be feasible to have them travel in camp or outfit cars.

Can Do Light Work

By A. E. Perlman
Chief Engineer, Denver & Rio Grande Western, Denver, Colo.

By reason of its nature, maintenance of way work is, to a large extent, beyond the physical capacity and adaptability of women. This is recognized by certain state laws which limit the weight that women may lift or carry. There are certain tasks in the bridge and building department, however, such as cleaning and preparing surfaces for painting, or other light work that must be done preliminary to the work of skilled workmen, which women can do. On the track, women are found to be quite adept at dressing ballast, caring for switch lamps in terminals, cleaning cinders and in the removal of snow.

The extent to which women may be used is contingent not only upon the maintenance of way jobs which they can do, but also on the maintenance of way jobs which they will accept. Opportunities for women without any skill, as trainees and otherwise, are more attractive than ever before, and in our territory we have found it more difficult to recruit women for common labor than to obtain men.

Situation Will Get Worse

By W. Woolsey
Section Foreman, Illinois Central, Chicago

There are numerous tasks that women can perform, and their employment for these tasks should be given serious consideration, for bad as the present shortage of labor is, it is likely to get worse before it starts to get better. They can clean up around stations and shop grounds and elsewhere where good appearance and neatness are desired. There are many places where weeds must still be destroyed manually, despite the use of mechanical and chemical weed killers, and this work can be done by women.

Women can dress the ballast and

make the ballast toe line behind large surfacing gangs. They can also do the necessary flagging for track gangs or run some or all of the power machines that are becoming so important today in maintenance work. Women can be employed in any or all of the foregoing jobs to release men for the heavier and more exacting tasks for which women are not adapted.

Saving Critical Materials

To what extent can the use of critical materials in water service be avoided by welding?

For Repairs Only

By P. S. Prevey
General Water Inspector, Chicago, Milwaukee, St. Paul & Pacific, Minneapolis, Minn.

In the present emergency, created by the war's demand for increased volume and tempo of operation, the water service plays a most important part. Water is necessary for the operation of trains, and materials of various kinds are necessary to secure the water and deliver it at the right place. In this vital service the welding torch has a place, but its role is solely in the field of repair; it cannot produce new materials, and most of the demand for increased water service can be met only by the use of new materials. Additional wells require new casing and later additional pumps, and increased volume of traffic and changes in methods of operation demand new pipe lines, new water columns, etc. In many cases the question resolves itself into which is the most critical—the service or the material. If the service is vital, then the material must be supplied. The welding torch cannot possibly solve many of these questions with which the water-service organization has to contend, with respect to additional materials.

Nevertheless, the welding torch can be used to some extent in the saving of material, especially for repairing broken or worn parts. This is not a new use of the welder, and the question now is how much its use can be extended in repair operations. The use of critical materials can be avoided in limited degrees through the following practices:

1. Welding joints in well casings will eliminate couplings.
2. Welded joints in steel pipe lines will eliminate the need for couplings, flanges or other fittings.
3. Building up worn parts of water columns by welding or brazing.
4. Welding or brazing cracked castings.
5. Welding patches or short pieces of pipe in existing pipe lines when repairs become necessary will eliminate the use of larger quantities of new material for replacement.
6. Cutting torches can be used to melt lead from abandoned cast-iron pipe lines, and thus avoid the purchase of new material.
7. Welding manhole frames and covers permits, in many instances, the utilization of what would otherwise be merely scrap materials.
8. Drill bits used by many well drillers can be "hard surfaced" with an electric welding torch and the purchase of new material thus avoided.
9. Pipe couplings can be built up by welding to make drive shoes for well drilling. This is not recommended as a practice, but in an emergency will save both material and time.

On the whole, it appears that any extension of the use of welding for conserving materials in water service is somewhat limited. Moreover, the materials—gas and welding rods—used in welding are also reaching the critical list and are disappearing from the market. They may soon be as difficult to obtain as pumps, pipe and other similar items. Through necessity, water-service men are improvising ways to avoid the use of critical materials.

There Are Many Ways

By C. R. Knowles
Superintendent Water Service (Retired) Illinois Central, Chicago

There are many ways in which welding can be employed to avoid the use of critical materials, but the extent to which it will be so employed will depend quite largely on the adaptability, initiative and ingenuity of the men in the water-service department. In the past, the use of welding has been governed largely by considerations of economy and expedience. However, the growing shortage of critical materials has made welding a necessity wherever it can be used. In view of existing conditions, economy may be of minor importance where welding releases materials urgently needed for war purposes.

Welding can be used extensively in making repairs to steel tanks. Spot welding is employed in repairing small holes in the tank shell, resulting from pits. Patches can also be applied over weakened or leaking areas of the tank, often avoiding the necessity for replacing entire sheets or courses. It can also be used in strengthening structural members which may have been weakened by corrosion.

Broken, worn or otherwise damaged parts may be repaired readily in most cases by welding. This applies generally to almost any kind of metal part, including steel, cast iron, wrought iron, aluminum, brass and copper. Well screens, well casings and drop lines may also be repaired by welding or brazing, and worn bearings and shafts can be built up and reconditioned by welding or brazing, followed by turning and refinishing in a lathe. The ends of water-column pipes, when corroded, and when worn where they pass through the packing, may be reconditioned by brazing the finished portion of the pipe with a non-corroding metal. When refinished, in addition to saving the pipe itself, the amount of packing required will be reduced materially, and as this is usually of rubber composition or leather, two of the most vital materials will be saved.

The application of welding in the construction and maintenance of pipe lines is practically unlimited in scope and offers the widest field in water service for welding. Reducers, bends of any angle or degree, tees, ells and branch connections can be fabricated by welding in almost every instance without the use of specials or other pipe fittings, practically the only special fittings required being valves and flanges.

Welding may be used for making repairs to field distribution systems carrying air, steam and water; it is adapted particularly for the construction and repair of shop, power house and enginehouse pipe systems carrying hot and cold water, and steam and air, as well as boiler—washing and blow-off lines. Other applications are in the maintenance of manifolds, headers, exhaust heads, oil and water separators, heaters, radiators and sand piping and fittings; stoves, furnaces and stacks, most of which are maintained by the water-service organization on many roads; blower lines, hand railings, coaling stations and equipment, as well as for many other purposes.

The water-service department was the last department on the railways, generally, to adopt welding as a regular practice. It is gratifying, however, to note that water-service men have been forging to the front rapidly in this field, and that they are now tak-

ing their places among the leaders in the important art of welding as it is applied in railway maintenance.

The majority of water-service repair gangs now include welding outfits as important adjuncts to their regular maintenance equipment. Water-service repairmen have become skillful and effective in welding and, in most instances, are capable of handling such welding problems as come within the scope of the water-service field. The ingenuity and initiative of the water-service repairmen is traditional on the railways, and they may be relied on to make the most of the modern art of welding in the conservation of materials vital to the conduct of this war, in which the railways are playing an essential part.

Supplementary Fire Equipment

Is it desirable to supplement the regular fire-fighting equipment in buildings during the war period? Why? If so, in what way? Who should be responsible?

Yes, if Inadequate

By F. R. Judd
Engineer of Buildings, Illinois Central, Chicago

In buildings where the regular fire-fighting equipment is deemed inadequate to meet the hazards brought about through increased business, it would not alone be desirable, but definitely advisable to supplement the regular equipment. This can be accomplished by either repairing or rebuilding existing equipment in need of such attention, by relocating existing equipment from less hazardous to more hazardous zones or, where possible under the present restricted procurement conditions, by purchase of additional new equipment. Recommendations for the proper utilization of present equipment, as well as for the purchase of new equipment considered necessary, should originate with the officer who is directly responsible for fire prevention.

Several Factors Involved

By General Inspector of Buildings

There are two phases to this question, depending on whether damage to or destruction of the building will interfere with the movement of traffic. There are a multitude of buildings on the railways that could be destroyed without affecting the movement of traffic, although their loss might be of serious importance for other reasons. Again, there is the question of fire hazard. Some buildings are under no more hazard today than they were before the war started; others may be subjected to considerably more hazardous exposure or a fire in them may be of far more serious consequence.

The fire-fighting equipment in a pier house, particularly if it is handling or holding military or naval stores, should have an ample installation of the best fire-protection equipment that can be obtained. If the present equipment in a shop, an enginehouse, a power plant or other building, the destruction of which will interfere with the handling or repair of locomotives, is inadequate to give reasonable protection, this equipment should be supplemented in such a way as to afford this protection. Likewise, the equipment in coaling plants, pump houses, interlocking towers and other buildings, the loss of which will affect train movements, should be considered on the same basis.

In giving consideration to this subject, it should not be overlooked that in many cases frequent and thorough inspection of the premises is as important and often more effective than fire-fighting equipment, if such inspections result in the correction of improper practices and the elimination of other hazards. In other words, it is far better to prevent a fire than to have one to fight. We cannot eliminate all fire hazards; all that we can do is to eliminate some and reduce others. On those roads that have fire-prevention organizations it is reasonable to assume that the buildings have already been given reasonable protection. If this has been done, it is only those buildings that have had their status changed by the extraordinary traffic we are now handling that need give us any special concern, with respect to our ordinary operations. If the buildings are in a zone that may be subject to enemy action, the situation is different, and requires special consideration in many of its phases.

Operators for Power Machines

In view of the present shortage of manpower, what practical methods can be employed to provide capable operators for power machines? What means can be employed to instruct them in their duties?

Pick Best Men

By J. G. Hartley
Assistant Engineer, Pennsylvania, Philadelphia, Pa.

A certain amount of preparatory work is needed to provide capable operators for power machines and instruct them in their use. This comprises the preparation of (a) a manual of instructions covering the general characteristics and operation of each type of maintenance of way equipment, fully indexed for quick reference; (b) a set of instructions covering the use of each type, with separate identification of each for quick reference; and (c) an alphabetical list of each type of equipment in use, with columns to the right, each of which is headed by reference to a rule, to timetable instruction, to safety rules, to mechanical equipment instructions, etc., with an (x) in the columns opposite each type of equipment listed to show the rules and instructions that govern the operation of the unit and in which the operator must qualify.

Every foreman and supervisor or roadmaster should pick carefully out of his force those who show mechanical aptitude in handling the work that is being performed. They should urge these employees to familiarize themselves with the instructions they must know before they can operate a power machine. They should also afford them the opportunity of operating the unit or units in actual service under the direct instruction and supervision of a qualified and experienced operator.

Each prospect should be examined fully with respect to the care and operation of the equipment, placing particular stress on the necessity for maintaining the equipment in his charge in working condition. He should be required to pass this examination satisfactorily before he is given a qualified rating.

Supervisory recognition by means

of personal commendation should be given those who perform their work well and incur the least running repairs.

It should also be taken into consideration that woman-power will be available to offset the shortage in manpower. Many women have a high degree of mechanical ability and after instruction can qualify as machine operators, if the present restrictions can be removed.

Stabilize the Jobs

By Engineer Maintenance of Way

While the army has taken a number of our men who are experienced in the operation of power machines, the demand for these men in war industries, where wages are well above what we can afford to pay, has taken a larger number. Not a few of these men would have remained with us if they could have been assured of year-round employment. I always have thought, and still do, that we make a serious mistake in giving only part-time employment to skilled men who are as necessary to our work as the operators of our power machines.

As I view the matter, an important item in replacing the men who have left us, is to be able to assure our prospects continuous employment. Otherwise, after they have qualified, they too may leave; in fact this has already happened. It might not be amiss, too, to point out to them their probable seniority rating when an ample supply of labor is again available. First, however, I would canvass the forces we now have to determine who among them is possessed of mechanical ability. As a rule, this information can be obtained by interviewing foremen and supervisors who are acquainted with them. However, I would also want to know something about the man's dependability and about his disposition and general reputation for honesty. It is a mistake to select a man who is quarrelsome and does not get along with other men or who has a persecution complex; that is, who believes that he is being done an injustice at every turn.

Having selected the prospect, he should be required to learn and pass an examination in the rules for the transportation department, so far as they apply to maintenance of way employees, and in those for the maintenance of way department, as well as in the safety rules. A man who does not know the requirements of these departments is a complete liability, particularly if his machine is one that does or may obstruct the track. He should then be placed with an experienced operator until he is able, under the operator's supervision, to handle the machine in actual service. During this period he should be taught the characteristics of the equipment and how it should be handled. I would then place him with the equipment maintenance until he is familiar with the construction of various machines and the requirements for their maintenance.

If the instruction has been to the proper standard, the man should now be qualified to operate the machine by himself. Whether he should be required to stand an examination on the mechanical and operating features of the equipment seems to be an open question which each road must decide for itself. How long should the instruction continue? There can hardly be a set time, for some men "catch on" much sooner than others. Furthermore, since this will be largely in the nature of individual instruction, there may be a similar differential in the instructors, or other conditions under which the instruction is given may differ quite widely.

Saving Rail on Ladder Tracks

Are there any advantages in installing rail and flange lubricators on ladder tracks as a measure to conserve rail? Any disadvantage? Where should they be placed?

Benefits Are Cumulative

By C. H. R. Howe
Cost Engineer, Chesapeake & Ohio, Richmond, Va.

Experience has proved the value of rail lubrication in yards and terminals, reports indicating that when switch points are lubricated properly, their life is increased approximately 100 per cent. The number of greasing machines required is governed by the volume of traffic, car movements, the number of turnouts, the length of leads and other conditions. In this service, a lubricator can be so placed that it will take care of an entire ladder track, protecting the curve leads as well as the switch points. For these purposes, the greasing machines are usually placed on pull-in or hump tracks. As elsewhere, the benefits of lubrication are cumulative, and grease applied to wheels of trains entering a terminal is also effective on outbound cars.

This practice may have certain relatively unimportant disadvantages. Engine sanding may tend to impede operation of some types of lubricators, and may to some extent form a soft abrasive compound. The latter may be kept to the minimum, however, by careful maintenance and adjustment of the greasing machine. Carelessly-regulated grease flow may create a bad situation for workmen on the tracks surrounding the location of the machine.

In general, best results may be expected by placing the rail and flange lubricators slightly ahead of the track to be greased. There are a few types of mechanical lubricators, however, which will give good results, and not at excessive maintenance cost, by being placed slightly on the curve instead of on the tangent.

Careful Analysis Required

By S. E. Armstrong
Engineer Maintenance of Way, New York Central System, New York

Careful analysis is required first to determine the place where the installation of rail and flange lubricators is warranted. If this analysis develops no objectionable features, there is a distinct advantage in making the installation of the lubricators to conserve rail on ladder tracks, for the lubrication thus provided will conserve not only the rail, but also other turnout material, particularly the switch points.

Local conditions will determine both the type of lubricator to be employed and where it should be placed. A lubricator of a certain design, capacity and lubricating value might serve satisfactorily in one situation where it would require installation directly ahead of and approaching the ladder. Another location may warrant the installation of a lubricator of heavier-duty type and permit its being placed either closely approaching the ladder or at a point sufficiently distant to permit lubrication of the approach or lead track as well as the ladder.

There are no disadvantages, except, because of local conditions, where excessive use of sand is required for locomotive traction. In this instance the mixture of the sand with the lubricating material forms an abrasive which might accelerate the wear on the rail and turnouts. As first mentioned,

where local conditions warrant their installation, rail and flange lubricators serving ladder tracks have definite advantages, but they should be installed only at locations where these benefits will be obtained.

Believes in Them

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

I am a firm believer in the value of rail and flange lubrication to prevent rail wear on curves. Where lubrication is applied to ladder tracks, not only is there a definite saving in rail wear, but the wear on the switch points is reduced correspondingly. It should not be overlooked in this connection that wear on the rail is accompanied by corresponding wear on the wheel flanges. Whether they are equal cannot be determined for unlike the rail and points which remain in a fixed place, the wheel passes on. Furthermore, cars with greased flanges run more freely because they do not bind on the rail as they do when no lubrication is applied.

In general, the lubricators should be placed where the cars or trains move fast, where little or no sand is used for starting or pulling the trains, for where considerable sand is used, it may be that the benefit of the lubrication will be offset by the abrasive action of the sand and grease.

How About Solder?

What is the effect of reduced tin content in solder? What special methods must be employed in applying low-tin solders? Does this differ for different applications?

Practices Differ

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

There is such a wide variation in the conditions under which soldering is done and such a diversity in the practices with respect to soldering that it is difficult to discuss the subject categorically. There is one item, however, that must be given first consideration in every case of soldering if the job is to prove successful; this is, that the metal to which the solder is to be applied must be thoroughly clean.

In discussing this question with the shop foreman at our reclamation plant, where a considerable amount of soldering is done daily, in response to a query as to the results obtained with solder having a reduced content of tin, he stated that the low-tin solders do not run as freely as the former solder, but that good results can be obtained if the acid is used at a higher strength than formerly, when 40/40 and 50/60 solders were being used. However, acid used to clean galvanized surfaces or other metal coatings should not be of such strength as to destroy the coating.

It is of importance, when using the low-tin solders, to keep the soldering irons hot while applying the solder. They should be changed and reheated as frequently as necessary to insure the desired high temperature. More care is needed also to insure that the irons are clean.

Low-tin solders cannot be used as effectively on old second-hand and rusted metals. However, if these surfaces are scraped and brushed with a wire brush to clean them as much as possible, satisfactory results can usually be obtained by following the suggestions already given for new metal surfaces.

In the reclamation shop which has been mentioned, in which many small oil and gasoline cans and other containers are made and repaired, welding is resorted to in many instances to avoid the use of the low-tin solder. For this purpose, ordinary second-hand or scrap bailing wire and other low carbon—soft—wire are being used. These wires are cleaned, straightened and cut to the desired length for welding rods. It is an interesting fact that this expedient is giving quite satisfactory results.

Is Not as Satisfactory

By V. Engman
Master Carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.

Ordinary solder consists of half lead and half tin, for which reason it is generally known as 50/50 solder. The war-emergency specifications for solder call for 85 per cent of lead and 15 per cent tin, designated as 85/15 solder. In general, this solder is less satisfactory than the 50/50 material, but it can be, and is being, used successfully. Some adjustment is necessary in the operation of applying it, and great care and higher temperature are required to obtain a satisfactory job.

Solder of the 50/50 variety begins to melt at 359 deg., F., and becomes completely liquid at 414 deg. An 85/15 solder begins to melt at 400 deg., and is not completely liquid under 554 deg. In the 50/50 solder the pasty range, in which the solder is partly liquid and partly solid, is quite narrow, being only 55 deg., while for the 85/15 solder this range is 154 deg., and the final melting temperature is 140 deg. higher than for the 50/50 solder. In this connection, it should be borne in mind that solder does not all melt at a given temperature, for certain parts melt at a lower temperature than other parts. If the temperature is brought above the initial melting point, but is kept below that of final melting, the mass will be partly melted and partly solid. It is important to understand this to appreciate the effect of the lowered tin content in the solder. Within limits, the lower the tin content the higher the melting point. This explains why higher temperatures are necessary with low-tin solders.

Tensile and shear strength decrease considerably as the tin content of the solder is decreased. This may not be particularly significant in many applications, but where the gap between adjacent parts is undesirably wide and the solder film is quite thick, the results of using low-tin solder may be unsatisfactory. Care should be exercised to make the joints properly, not only to keep the solder film thin, but to conserve the critical material, tin, which the solder contains, although in reduced amount.

About the same proportional loss occurs in the bond strength between the solder and the surfaces to be joined, when the tin content is lowered, as in the tensile and shear resistance of the solder itself. It is only in joints that are stressed to near the point of failure that this consideration is likely to become important. However, the bond strength varies with the kind of metal that is being soldered, this being due to the difference in the "wetting" properties of the solder on the metal. Some metals become "wetted" more easily than others, the tin in the solder being the wetting agent. The wetting of copper, brass and other non-ferrous metals is reasonably easy, but the reduction of the wetting power of 85/15 solder, compared with the 50/50 product, is quite noticeable.

The spreading rate, which has a very direct bearing on the ease of soldering many types of joints, also suffers as the tin content is lowered. This makes it more difficult to pro-

mote the production of a reliable joint where the solder must flow through fairly long joints. Obviously, special pains must be taken with the cleaning and fluxing operations and to insure that the necessary temperature is reached and held until the solder has penetrated through the joint. Joints in which the flow cannot be determined readily will give the most trouble with low-tin solders. Some jobs of this type may be handled better by changing to low-temperature brazing instead of soldering.

Keeping Down Personal Injuries

What measures to prevent personal injuries to trackmen should be taken now that are not considered necessary normally? Why? Who should be responsible?

Education Best Method

By E. M. Bergee
Track Foreman, Atchison, Topeka & Santa Fe, Shopton, Iowa

Every railway is striving, more or less effectively, to reduce the hazards of personal injury. It is my observation that the best method of accomplishing this purpose is constant schooling of the men employed in various pursuits. The method of teaching will differ for different classes of work, for not all employees are subject to the same hazards. The switchman is exposed to one set, the trainmen to another, but both differ from the trackman, the machinist and the freight handler, and they from each other.

A complete investigation should be made of every injury to determine why it occurred and what can be done to prevent a repetition. If the foreman in charge has been lax in his enforcement of safety rules he should be held responsible and disciplined accordingly. I was present at a safety meeting several years ago, at which the superintendent of safety of a large road made the statement that no one wants to suffer a personal injury and, therefore, would not hurt himself intentionally, for which reason, when an injury occurs some one else than the injured person is to blame.

I did not agree with him then and do not now. To illustrate, the oldest and still the most common form of injury is the mashing of fingers when pulling spikes on the gage side of the rail. Every trackman is shown how to do this safely, but despite this instruction and constant watch, this form of injury occurs over and over again, even among men of long experience. The only explanation of these injuries is that the men allow themselves to become careless momentarily in the way they hold the claw bar.

A foreman who does not instruct his men and practice safe methods himself should be taken off the job. Yet even the most capable and alert foreman cannot keep injuries out of his gang unless the men are willing to listen to and carry out safety instructions. The only recourse is to get rid of the man who is not safety minded. Again, a foreman of a large gang cannot watch every man individually. For this reason, when starting a new man, he should give him safety instructions, then place him alongside a dependable experienced man until he has learned safe methods.

I do not believe that a foreman should be held responsible for injuries received by a man whom he has instructed in safety rules and practices, but who has deliberately ignored them, any more than a trainmaster should be held responsible for an engineer running a red signal and causing an accident. In any event, the person who has disobeyed the rule should be held responsible in whole or in part.

Depends on Head

By W. E. Folks
Track Supervisor, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio

If a well-balanced safety effort is to be made, it must be carried on constantly and persistently, with no compromise or relaxation. In those years when we were blessed with trained and experienced men, much time and patience were needed to keep them on the alert to follow safety practices, so that they would not injure themselves or their fellow workmen. A check of past records will disclose that about 80 per cent of the personal injuries that occurred were to employees of long experience and training, or were caused by them. In any event, new employees caused or suffered injuries to only a minor extent, compared with those of experience and training, some of them over many years.

As to responsibility, in the last analysis this rests directly on the head of the department; there can be no doubt or misunderstanding about this, for if he is safety minded and lets it be known by both word and action, everyone in the department will be safety minded and will follow safety practices. If he is indifferent, this attitude will permeate the entire organization, the enforcement of safety rules will be lax and injuries will multiply. It has not been many years since accident prevention was not taken too seriously, and there were injuries a plenty. Today, supervisors go out among the men and preach safety, teaching both foremen and laborers that they are equally responsible for accident prevention, with the officers of the railway. Every supervisor should bear in mind that the organization he heads is made up of *his* men and it is his duty to do everything that is humanly possible to educate them in accident prevention by both precept and example.

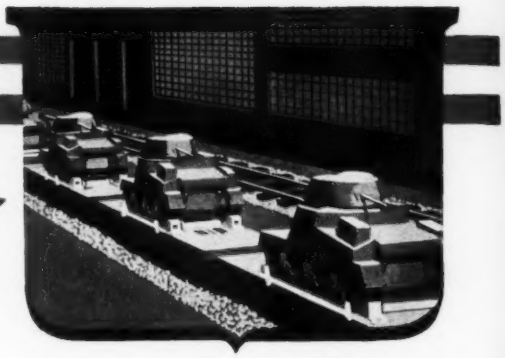
Must Always Be Alert

By M. J. Hanna
Private, 715th Battalion, Military Railway Service, Camp Shelby, Miss.

Responsibility for the safety of his men rests heavily upon the foreman directly and on the supervisor indirectly. If he is not on the alert constantly, even a minor laxity may result in one or more personal injuries. One point that should be stressed particularly is the wearing of goggles. I have heard men say that, "I have worked for 5," or perhaps 15, "years and never got anything in my eye, so why should I wear goggles now?" The foreman should insist on the use of the goggles when the task calls for them, for it matters not how many years of immunity a man has enjoyed if he loses an eye now.

This only illustrates the fact that the foreman must always be alert, even when working experienced men. Now that he is forced to take men of no experience, many of whom are at an age where they have certain fixed habits that are hard to overcome, he must be more alert to watch and teach them how personal injuries and other accidents are to be prevented. It is not going to be an easy task, but it presents a challenge to the foreman who has the right understanding of his task and of his responsibility in the matter. We are going through abnormal times and we must accustom ourselves to unaccustomed situations, carrying on earnestly but gladly to do our part in the supreme effort that so many of our men are making for the safety of our country.

NEWS of the Month



Changes in Construction Conservation Order L-41

Several changes have been made by the War Production Board in the Construction Conservation Order L-41 which controls most types of civilian construction. One of the major amendments which has to do with the railroads includes the following change: Construction of railroad tracks is exempted from the provisions of Order L-41. Buildings, tunnels, overpasses, underpasses or bridges, however, are still covered. Applications for laying trackage already are handled by the Transportation Equipment Division and the change was made to eliminate unnecessary paper work.

Acts to Relieve Track Labor Situation in the Southwest

Approval of proposals to import Mexican laborers to serve as track workers on southwestern railroads has been granted by the War Manpower Commission, as part of a general program for the relief of labor shortages in that territory.

After agreements are worked out, it is said that men will be brought from other sections of the United States, as well as from Mexico, under plans designed to protect seniority rights, retirement benefits, and established working conditions, as well as to obtain from the employee some assurance of intention to accept steady employment, in which the Railroad Retirement Board, the federal employment service and other interested agencies will participate. It is expected that details of the program will be made public in the near future.

N.Y.C. Film of Best Track Work Practices

The New York Central is showing a film—"Seeing Is Believing"—to make known among track men throughout the system the best methods of performing various kinds of track work.

The thought behind the film is that, if the best method of doing each job is ascertained and publicized, the entire system may have the opportunity to bring its performance up to the best. To seek out these best methods, a committee was appointed some four years ago to examine and select what appears to be the most efficient technique for each job.

Experience showed that other methods of publicizing good methods were not fully effective, and so the film medium is being used, with highly satisfactory results. The film shows not only the best practices, but also those to be avoided. It is accompanied by a sound-track of descriptive comment.

Railroads Made Available 100 Million Ft. of Rail in 1942

A total of 76,963,843 lin. ft. of rail suitable for relaying purposes was released by the railroads of the United States and allocated by the War Production Board for use in newly-laid tracks during the period from April 22, 1942, to December 31. April 22 was the date when Order L-88 became effective, requiring the railroads to release old rail in exchange for new rail and making the disposal of all old rail subject to WPB order, except rail to be used by railroads in existing tracks.

Of the total relay rail allocated during the period, 29,753,273 ft. went to the Army, 11,845,136 ft. to the Navy, 3,645,020 ft. to the Maritime Commission and 31,725,414 ft. was allocated for miscellaneous uses, consisting chiefly of new industry tracks laid by railroads and extensions to railroad tracks. Although complete records prior to the control period are lacking, WPB surmises that the railroads probably released about 100,000,000 lin. ft. of relay rail last year, instead of approximately 85,000,000 lin. ft. as previously predicted.

Mediation Fails and Arbitration Refused

Efforts to mediate the demands of the 14 non-operating unions and the Hotel and Restaurant Employees' International Alliance for a wage increase of 20 cents an hour, a minimum wage of 70 cents an hour and a closed shop begun at Chicago on January 7, failed on January 15 and on the following day both parties refused to arbitrate some or all of the points at issue. In announcing the failure of mediation, George A. Cook, chairman of the National Mediation Board, stated that the next step will be an applictaion by the unions to William M. Leiserson, chairman of the National Railway Labor Panel, asking that body to assume jurisdiction. "This would mean," Mr. Cook said, "that there will be no necessity for taking a strike vote or fixing a date to strike."

When mediation ended, the railroads recommended that wage adjustments made by the National Railway Labor Panel should be in keeping with the inflation control policy established by the National War Labor Board and have its approval. The unions wish the Panel to be independent and contend that the Labor Panel could be made responsible for carrying out the policies of the anti-inflation act of October 2. It is understood that two executive orders have been prepared for President Roosevelt and that the matter of authority will be settled shortly.

Accidents Increase

The annual report of the Bureau of Safety for the fiscal year ending June 30, 1942, which was made public in January, emphasized the "material increase" in railroad accidents and remarked that "war traffic has introduced conditions which require greatly increased effort and additional facilities to prevent accidents. The number of railroad employees has grown rapidly and is increasing month by month. Consequently, the methods and personnel provided by the railroads for instructing, training and supervising inexperienced employees must be improved and expanded."

Safety of operation has been "seriously impaired" in many localities, the report points out, by the intensive use made of railroad facilities where extensive war industries have been developed, and more generally by the increase in the number and the length of the trains operated. "Restrictions upon the use of materials required for railroad facilities and equipment have resulted in serious delays in revising existing installations, making necessary new installations, and securing needed replacements and additions. Intensive use of locomotives and cars required to handle present traffic and curtailment of construction of new locomotives and cars require extraordinary efforts by inspection and repair forces of the railroads and have placed increased responsibility upon supervisory forces of the railroads and upon our inspectors to maintain necessary standards and precautions for safety of operation."

Accident statistics included in the report indicate that in the fiscal year the commission received reports on 3,682 collisions and 5,837 derailments, or 9,519 such accidents as compared with 6,471 in the year before. The number of persons killed was 221, as compared with 183 in the preceding 12 months, while 1,973 were injured, as compared with 1,477.

Continued progress was reported in the elimination of highway grade crossings, the net decrease during the calendar year 1941 being 939, leaving the total number of such crossings on that date 229,722.

(Continued on page 127)

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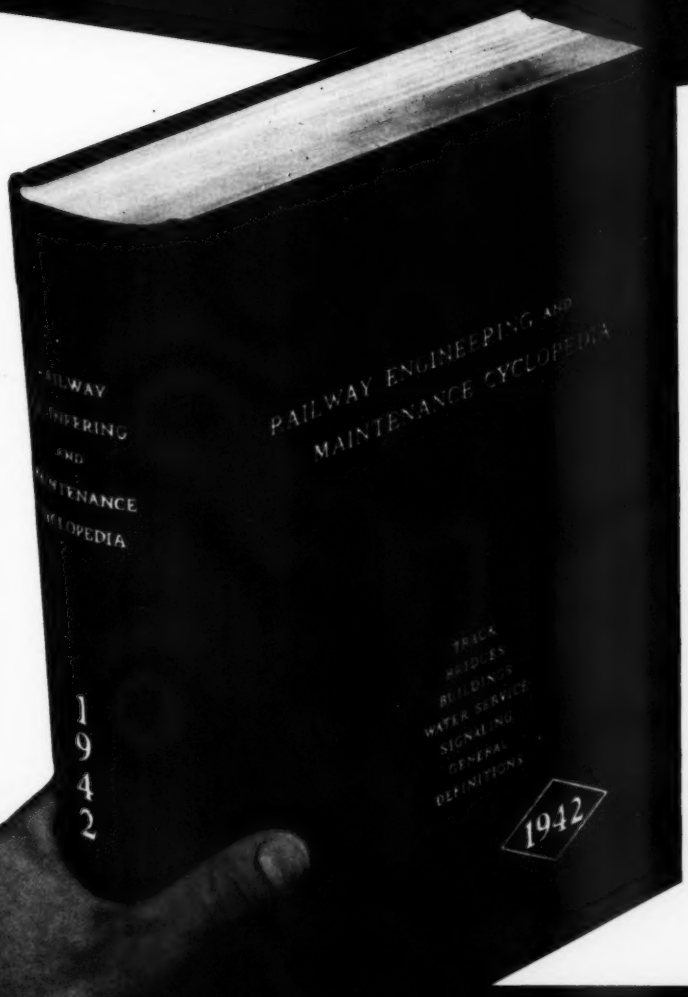

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Personal Mention

General

J. F. Pringle, chief of transportation for the Canadian National system, with headquarters at Montreal, Que., and an engineer by training and experience, has been promoted to general manager of the Atlantic region, with headquarters at Moncton, N.B.

Ian Warren, overseas passenger manager of the Canadian Pacific, and an engineer by training and experience, has been appointed assistant passenger traffic manager, with headquarters as before at Montreal, Que. In his new position, Mr. Warren will have charge of military and other special traffic, as well as overseas traffic. Mr. Warren, who was born on July 27, 1904, at Montreal, Que., attended St. Kevin's college. He entered railroad service in 1920, as an employee in the office of the chief engineer of the Canadian Pacific. After experience in the engineering and construction departments, he joined the passenger department in 1924, as secretary to the assistant passenger traffic manager, serving in this capacity until 1927, when he became assistant chief clerk in the passenger traffic department. He was appointed assistant to the overseas passenger manager in 1930, and subsequently in 1939 was advanced to overseas passenger manager, which position he held until his recent appointment.

Joseph R. Thexton, terminal trainmaster of the Delaware, Lackawanna & Western at Hoboken, N.J., and an engineer by training and experience, has been promoted to superintendent of the Morris and Essex division, with the same headquarters. Mr. Thexton entered the service of the D. L. & W. in April, 1906, as a messenger in the freight office at Buffalo, N.Y., becoming file and time clerk in the superintendent's office in December, 1907. In April, 1910, he was transferred to the engineering department as a rodman at Buffalo, later being advanced to instrumentman. From October, 1914, to March, 1916, he was baggage agent at Elmira, N.Y., and Buffalo, subsequently becoming efficiency clerk at East Buffalo, N.Y. He advanced to yardmaster at East Buffalo in April, 1920, became a general yardmaster at Syracuse, N.Y., in 1926, and in December, 1935, he was appointed special representative on the staff of the general superintendent at Scranton, Pa. Mr. Thexton became terminal trainmaster at East Buffalo in January, 1940, and in January, 1941, he was transferred to the Morris and Essex division at Hoboken, where he remained until his recent promotion.

David E. Smucker, assistant superintendent of freight transportation of the Pennsylvania, Western region, with headquarters at Chicago, and an engineer by training and experience, has been promoted to superintendent of the Indianapolis division, with headquarters at Indianapolis, Ind. Mr. Smucker was born at West Liberty, Ohio, on October 3, 1907, and graduated in civil engineering from Ohio State University in June, 1929. He entered railway service on May 23, 1929, as an assistant on the engineer corps of the Pennsylvania. On August 1, 1929, he was promoted to assistant supervisor at Harrington, Del., and later served in that capacity successively at Lemoyne, Pa., Washington, D.C., and Philadelphia, Pa. Mr. Smucker was promoted to supervisor of track, with headquarters at Clayton, Del., on April 9, 1934, and on October 10, 1935, he was transferred to Perryville, Md. In August, 1940, he was advanced to assistant division engineer at Ft. Wayne, Ind., and in October, 1940, he was promoted to division engineer of the Toledo division, with headquarters at Toledo, Ohio. Mr. Smucker was appointed assistant superintendent of freight transportation, Western region, with headquarters at Chicago, in January, 1942, which position he held until his recent promotion, effective January 16.

Engineering

G. S. Crites, division engineer on the Baltimore & Ohio at Punxsutawney, Pa., has been transferred to Baltimore, Md.

R. T. Scholes, assistant to the chief engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, retired on January 31 at his own request.

M. H. Brown, superintendent maintenance of way and structures of the Butte, Anaconda & Pacific, has been promoted to chief engineer, with headquarters as before at Anaconda, Mont.

J. B. Arter, supervisor of track on the Baltimore & Ohio at Decatur, Ill., has been appointed assistant engineer in the office of the engineer maintenance of way at Pittsburgh, Pa.

F. A. Poling has been appointed assistant to the engineer maintenance of way and structures of the Wheeling & Lake Erie, a newly created position, with headquarters at Brewster, Ohio.

F. E. Wall, assistant engineer on the Alton, with headquarters at Chicago, has been appointed acting assistant division engineer of the Western division, with headquarters at Bloomington, Ill., succeeding **H. W. Miner,** who has been commissioned a captain in the U. S. Army.

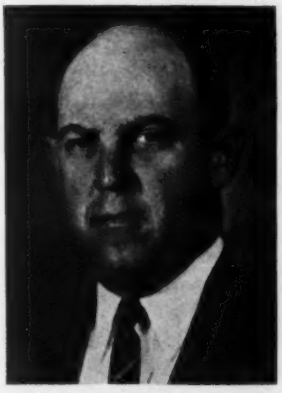
F. R. Michael, division engineer on the Wabash at Moberly, Mo., has been promoted to engineer of track, with headquarters at St. Louis, Mo., succeeding **Charles T. Warren,** who has entered military service as a major in the transportation corps. **G. F. Rothwell,** first assistant engineer at Moberly, has been advanced to division engineer at that point, relieving Mr. Michael.

Gustave A. Haggander, assistant chief engineer of the Lines East of the Missouri River of the Chicago, Burlington & Quincy, has been promoted to assistant chief engineer of the Burlington Lines (including the Chicago, Burlington & Quincy, the Colorado & Southern, the Ft. Worth & Denver City, and the Wichita Valley), with headquarters as before at Chicago. **Elzear J. Brown,** assistant division superintendent on the C. B. & Q., at Galesburg, Ill., has been promoted to the newly created position of engineer of track of the Burlington Lines, with headquarters at Chicago. **George W. Gallier,** assistant engineer on the C. B. & Q., at Chicago, has been advanced to assistant

Gustave A. Haggander

chief engineer of the Lines East of the Missouri River, with the same headquarters, succeeding Mr. Haggander. **Charles W. Breed,** office engineer, has been advanced to the newly created position of engineer of standards, with headquarters as before at Chicago.

Mr. Haggander was born at Sioux City, Iowa, on January 30, 1885, and graduated from the Armour Institute of Technology,



Elzear J. Brown

Chicago. He entered railway service in 1905 as a draftsman in the office of the bridge engineer of the Burlington, later serving as a concrete inspector and a designer. On June 10, 1910, he was promoted to office engineer and two years later he was advanced to assistant bridge engineer of the Lines East of the Missouri River, with headquarters at Chicago. Mr. Haggander was promoted to bridge engineer of the Burlington system in 1916, with headquarters as before at Chicago, and in December, 1938, his jurisdiction was extended to include the Colorado & Southern and Ft. Worth & Denver City. On May 16, 1939, Mr. Haggander was pro-

moted to assistant chief engineer of Lines East of the Missouri River of the C. B. & Q., which position he held until his recent promotion, effective February 1.

Mr. Brown was born at St. Joseph, Mo., on December 1, 1900, and attended the St. Joseph Commercial college and St. Patrick Commercial academy. He entered railway service on May 26, 1919, as a clerk in the general yardmaster's office on the Burlington at Chicago, and was later transferred to the superintendent's office. On June 1, 1920, he was appointed assistant roadmaster, later returning to a clerical position at Chicago. The following year he was appointed an assistant extra gang foreman and in November, 1921, he was promoted to section foreman. During the next four years Mr. Brown served as section foreman and extra gang foreman at various points in Illinois and Wisconsin. In January, 1925, he was advanced to assistant roadmaster on the Chicago-Aurora division and in September, 1926, he was transferred to Beardstown, Ill. One month later he was promoted to roadmaster, with headquarters at Chicago, and on May 16, 1939, he was promoted to district engineer maintenance of way, with headquarters at Galesburg. Mr. Brown was advanced to assistant superintendent of the Galesburg-Beardstown division in January, 1942, the position he held until his recent promotion.

Thomas L. Landers, whose appointment as chief engineer of the Atlantic region of the Canadian National at Moncton, N.B., succeeding **Frederick O. Condon,** retired, was reported in the January issue, was born on December 15, 1887, at Farnham, Que. Mr. Landers was graduated from Bishops college, Lennoxville, Que., in 1908, after which he attended McGill university until 1909. He entered railway service in June, 1910, as a rodman on the Canadian Pacific at Farnham, subsequently being advanced to draftsman and instrumentman at that point. In October, 1913, he went with the Canadian Government Railways (now Canadian National), as a transitman at New Glasgow, N.S. He was appointed resident engineer of the

Thomas L. Landers

Canadian National, with headquarters at Truro, N.S., in May, 1915, and in January, 1917, became assistant engineer at Levis, Que. In September, 1919, Mr. Landers was appointed division engineer at Edmonston, N.B., and he was advanced to engineer maintenance of way, at Moncton, in November, 1927, which position he held until his recent promotion.

Mr. Condon was born at Moncton on July 21, 1878. On February 14, 1893, he entered the employ of the Intercolonial (now Canadian National) as a messenger in the office of the chief engineer at Moncton. On April 1, 1912, he was advanced to resident engineer of the Intercolonial at Moncton, and on September 1, 1913, was transfered to the Canadian Government Railways as resident engineer at Campbellton, N.B. On January 1, 1916, he was appointed district engineer at Moncton, and until his recent retirement maintained headquarters at that city. On March 1, 1923, he was appointed engineer maintenance of way of the Eastern lines of the Canadian National, and on May 15, 1927, was appointed principal assistant engineer of the Atlantic region, becoming office engineer on September 1, 1932. On January 1, 1938, he was appointed chief engineer of the Atlantic region. Mr. Condon is a member of the Engineering Institute of Canada, of which he was

Frederick O. Condon

counsellor in 1926, and vice-president in 1928 and 1929, and a member and past president of the New Brunswick Association of Professional Engineers.

J. L. Cox, assistant engineer in the office of the engineer maintenance of way —system, of the New York Central, with headquarters at New York, has been promoted to division engineer of the Erie division, with headquarters at Erie, Pa., to succeed **S. C. Upson,** who has been appointed special engineer, with the same headquarters. **George Auer, Jr.,** assistant engineer of track of the New York Central, Lines East of Buffalo, with headquarters at New York, has been promoted to assistant engineer in the office of the engineer maintenance of way—system, to succeed Mr. Cox. **Francis A. Haley,** supervisor of track on the Pennsylvania division, with headquarters at Corning, N.Y., has been promoted to assistant engineer of track at New York, to succeed Mr. Auer.

Mr. Auer was born on October 10, 1898, at Tuckahoe, N.Y., and graduated in civil engineering from Columbia university. He entered the service of the New York Central on March 6, 1918, as a chainman in the office of the district engineer at New York, being advanced to rodman at the same point the following May. On November 1, 1923, Mr. Auer was promoted to instrumentman, also at New York, and on April 16, 1924, he was further advanced to clearance engineer in the office of the engineer maintenance of way at New York. On December 1, 1925, he became assistant supervisor of track at Rochester, N.Y., holding this position until late in 1937, when he was promoted to supervisor of track at Corning. In 1940, Mr. Auer was promoted to assistant engineer of track, with headquarters at New York, which position he held until his recent appointment as assistant engineer.

Mr. Haley was born on January 7, 1894, at Watertown, N.Y., and is a graduate in civil engineering of Cornell university. He entered the service of the New York Central on September 12, 1920, as a rodman at Watertown, being advanced to transitman at the same point two years later. On April 16, 1929, he was promoted to assistant supervisor of track, with headquarters at Malone, N.Y. On October 20, 1931, he was transferred to Hudson, N.Y., and on October 1, 1937, he was appointed bridge and building inspector, with headquarters at Beacon, N.Y. Mr. Haley was promoted to supervisor of track at Corning on July 1, 1940, which position he was holding at the time of his recent promotion to assistant engineer of track.

Joseph William Jones, assistant engineer on the Baltimore & Ohio, has been promoted to senior assistant engineer, with headquarters at Baltimore, Md. Mr. Jones, who was born on November 24, 1896, at Baltimore, Md., entered railroad service on October 18, 1917, as a chainman on the Baltimore & Ohio, and became a rodman on August 1, 1918. Subsequently, Mr. Jones held the position of inspector from October 1, 1918, until March 1, 1919, when he was appointed engineering accountant. On May 15, 1922, he returned to the position of inspector and on July 1, 1923, was promoted to transitman, remaining in this position until July 1, 1927, when

Joseph William Jones

he became field engineer. From May 1, 1932, to August 1, 1934, he was again employed as a transitman, and on the latter date returned to the position of field engineer, becoming resident engineer on Oc-

(Continued on page 130)

tober 1, 1935. On October 1, 1937, Mr. Jones was appointed assistant engineer, the position he was holding at the time of his recent promotion.

William M. Young, assistant engineer on the Baltimore & Ohio, has been promoted to assistant to the chief engineer,

William M. Young

with headquarters at Baltimore, Md. Mr. Young was born on August 3, 1898, at Baltimore, Md., and attended the Baltimore Polytechnic Institute and Johns Hopkins university. He entered railroad service on September 1, 1916, as a chainman of the Baltimore & Ohio, becoming rodman on October 16, 1916. He was appointed levelman on May 1, 1917, and transitman on October 1, 1917. Subsequently Mr. Young became field engineer, and on March 1, 1929, was appointed assistant engineer, which position he held until his recent promotion.

Frank B. Baldwin, engineer of inventories of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, has been promoted to valuation engineer of the Santa Fe system, with the same headquarters, succeeding **Joseph Weidel,** who retired on January 16. Mr. Baldwin was born at Ellisville, Ill., in 1884, and gradu-

Frank B. Baldwin

ated in civil engineering from the University of Illinois in 1909, later attending the Kent College of Law at Chicago. He entered railway service in 1907 during a summer vacation from school as a masonry inspector on the Santa Fe at Chillicothe, Ill., and following graduation, he returned to the Santa Fe as a rodman at La Plata, Mo. From 1910 to 1911 he worked for the Missouri Valley Bridge & Iron Co., and the Illinois Highway Commission and in September, 1911, he returned to the Santa Fe as a draftsman at Topeka, Kan. In 1915 Mr. Baldwin was transferred to the valuation department and has been in intimate contact with all phases of valuation work. He has represented the valuation department of the Santa Fe before the Interstate Commerce Commission on numerous occasions.

Mr. Weidel was born in Lafayette county, Tex., on February 22, 1873, and entered railroad service in 1900 as a chainman on the Santa Fe at Pueblo, Colo., later being advanced successively to draftsman, instrumentman and assistant engineer on various work in Colorado and New Mexico. In 1902, he went with the Mexican Central (now a part of the National Railways of Mexico), as resident engineer and in 1904, he returned to the Santa Fe as assistant engineer with headquarters at La Junta, Colo. In 1906 he was employed on railroad construction work in the

Joseph Weidel

sugar beet territory of eastern Colorado and in 1907 he returned to the Santa Fe as engineer in charge of the construction of the Raton tunnel at Raton Pass, N.M. In 1911, Mr. Weidel was transferred to Topeka, Kan., being advanced to system valuation engineer in 1915.

Track

C. W. Russell has been appointed track supervisor on the Southern at Centralia, Ill., succeeding **J. R. Brosman.**

G. W. Shafer, section foreman on the Illinois Central at Ft. Dodge, Iowa, has been promoted to acting supervisor of track, with the same headquarters, succeeding **B. E. Moss,** who has been granted a leave of absence because of illness.

O. L. Kovar has been appointed roadmaster on the Union Pacific at Valley, Neb., with jurisdiction from Summit, Neb., to Columbus, succeeding **M. M. Thomas,** who has been transferred to the Beatrice and Stromsburg branches, with the same headquarters, relieving **M. C. Day,** who has been appointed assistant roadmaster at Omaha, Neb.

George Caraboa, assistant supervisor of track on the New York Central (Big Four) at Kankakee, Ill., has returned to his former position as section foreman and the position of assistant supervisor of track at Kankakee has been abolished.

D. Sullivan, track supervisor on the Arkansas division of the Chicago, Rock Island & Pacific, has been promoted to roadmaster with headquarters at Chickasha, Okla., succeeding **John W. Shurtleff,** who has enlisted in the Military Railway Service, Transportation Corps, U. S. Army.

J. F. Smith, roadmaster on the South Texas district of the Missouri-Kansas-Texas, with headquarters at Waco, Tex., has been promoted to general roadmaster, a newly created position, with headquarters at Dallas, Tex., and **L. M. Berger** has been appointed roadmaster at Waco, succeeding Mr. Smith.

R. C. Widdows, general foreman on the Baltimore & Ohio, has been promoted to supervisor of track at North Vernon, Ind., succeeding **B. C. Runyan,** who has retired. **N. W. Martin,** general foreman, has been advanced to supervisor of track at Carlyle, Ill., relieving **B. O'Brien,** who has retired.

Thomas J. Reilly, whose promotion to roadmaster on the Southern Pacific, with headquarters at Los Angeles, Cal., was reported in the January issue, was born in County Cork, Ireland, on November 1, 1906, and entered railway service on June 7, 1925, as a section laborer on the Southern Pacific. From August 1, 1925, to June 15, 1927, he served as student foreman on extra gangs and from the latter date until his recent promotion, served as section and extra gang foreman on the Colton district.

Robert C. Smith, whose promotion to roadmaster on the Chicago & North Western at Redfield, S.D., was reported in the January issue, was born at Parker, S.D., on August 29, 1903, and entered railway service on April 1, 1919, as a section laborer on the North Western at Canistota, S.D. On March 1, 1925, he was promoted to section foreman at Canova, S.D., and on March 1, 1934, he was transferred to Beresford, S.D. Mr. Smith was advanced to assistant roadmaster at Mason City, Iowa, on March 26, 1941, which position he held until his recent promotion, effective January 1.

Stanley B. Harrison, whose promotion to roadmaster on the Canadian Pacific, with headquarters at Nakusp, B. C., was reported in the December issue, was born at Brisco, B. C., on December 12, 1906, and entered railway service in October, 1923, with the Canadian Pacific, working periodically until May 17, 1926, when he entered permanent service as a section man at Luxor, B. C. In September, 1927, he was promoted to relieving section foreman and worked in that capacity and as a section man until February, 1930, when he was advanced to regular section foreman on the Cranbrook subdivision. In March, 1942, Mr. Harrison was promoted to acting road-

(Continued on page 132)

master and served in that capacity successively on the Esquimalt & Nanaimo (leased by the C.P.R.), and the Kootenay and Revelstoke divisions, until his recent promotion.

Frank L. Vault, Jr., whose promotion to supervisor of track on the New York Central, with headquarters at Remsen, N. Y., was reported in the January issue, was born on July 31, 1903, at Mallory, N. Y., and studied mechanical engineering at Rensselaer Polytechnic Institute. He entered the service of the New York Central on April 1, 1926, as a carpenter helper on the Adirondack division. On August 1 of the same year he became a chainman in the engineering department at Utica, N. Y., being advanced to rodman at the same point on June 1, 1927. From that date until 1936, Mr. Vault held various positions, then being appointed assistant supervisor of track at Malone, N. Y. On October 1, 1937, he was transferred to Hudson, where he remained until his recent promotion to supervisor of track, which was effective on December 2.

Spirlen Shelton, whose promotion to roadmaster on the Missouri & Arkansas, with headquarters at Leslie, Ark., was reported in the January issue, was born at Shirley, Ark., in 1902, and entered railway service in 1922 as a section laborer on the Missouri & Arkansas at Arlberg, Ark., later transferring to the mechanical department at Harrison, Ark. He returned to Arlberg as a section laborer in June, 1929, and was later promoted to section foreman at Georgetown, Ark. Mr. Shelton was then transferred successively to Kensett, Ark., Leslie, Heber Springs, Green Forest and Wheatley. In 1939 he was advanced to extra gang foreman and in 1942 he was appointed operator on a Jordan ditcher, which position he held at the time of his recent promotion, effective December 1.

P. A. Cosgrove, acting supervisor of track on the Illinois Central at Carbondale, Ill., has been promoted to supervisor of track at Olney, Ill., succeeding **F. B. Noonan,** who has been transferred to Gilman, Ill., replacing **A. J. Butler,** whose death is reported elsewhere in these columns. **R. A. Trammel,** chief clerk to the division engineer at Carbondale, has been advanced to acting supervisor of track at that point, relieving Mr. Cosgrove.

Mr. Cosgrove was born at L'Anse, Mich., on January 3, 1916, and graduated in civil engineering from the Michigan College of Mining and Technology, Houghton, Mich., in 1937. He entered railway service on May 1, 1940, as a chairman in the engineering department of the Illinois Central at Champaign, Ill., and on April 7, 1941, he was promoted to assistant supervisor of track at Champaign. On June 15, 1941, Mr. Cosgrove was transferred to Centralia, Ill., in charge of yard construction at that point and on June 10, 1942, he was advanced to acting supervisor of track at Carbondale, which position he held until his recent promotion, effective January 11.

Homer B. Rutherford, assistant supervisor of track on the New York Central, at Beacon, N.Y., has been promoted to supervisor of track of Subdivision 24 of the Pennsylvania division, with headquarters at Corning, N.Y., to succeed **Francis A. Haley,** whose appointment as assistant engineer of track is noted elsewhere in these columns. **Eugene B. Francis,** assistant supervisor of track of Subdivision 20 of the River division, with headquarters at Newburgh, N.Y., has been transferred to Subdivision 3 of the Eastern division at Beacon, to succeed Mr. Rutherford, and **Theodore M. Kohlman,** a member of the engineering corps of the Electric division at New York, has been promoted to assistant supervisor of track at Newburgh, to replace Mr. Francis.

Mr. Rutherford was born on December 27, 1898, at Madrid, N.Y., and studied civil engineering at Clarkson college. He entered the service of the New York Central on July 8, 1921, as a chainman at Oswego, N.Y., being advanced to rodman at that point on August 15, 1922, and, then to transitman on September 15, 1929. On October 1, 1934, Mr. Rutherford was promoted to assistant supervisor of track at Malone, N.Y., being transferred to Newburgh in 1936. Four years later he was transferred to Beacon where he was located at the time of his recent promotion to supervisor of track.

Bridge and Building

Matt Kleigel whose promotion to master carpenter of the Illinois division of the Chicago, Rock Island & Pacific, with headquarters at Rock Island, Ill., was reported in the January issue of *Railway Engineering and Maintenance* was born at Downing, Wis., on August 18, 1897, and entered railway service on May 15, 1917, in the water service department of the Chicago & North Western at Mason City, Iowa. On May 15, 1920, he went with the Rock Island as a steam fitter in the mechanical department at Manly, Iowa, and in June, 1922, he left railway service for other employment, returning to the Rock Island on September 1, 1923, as a water service mechanic at Iowa Falls, Iowa. On September 9, 1925, he was promoted to water service foreman at Goodland, Kan., and on November 9, 1929, he was transferred to Cedar Rapids, Iowa. Mr. Kleigle was promoted to assistant master carpenter at Cedar Rapids on July 1, 1937, and on April 1, 1938, he was advanced to district supervisor of water service, with headquarters at Kansas City, Mo. On March 9, 1942, because of a reorganization of the water service department on the Rock Island, Mr. Kleigle returned to Cedar Rapids as water service foreman, which position he held until his recent promotion.

Obituary

A. J. Butler, supervisor of track on the Illinois Central at Gilman, Ill., died suddenly of a heart attack on December 26, 1942.

G. W. Lanning, master carpenter on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Milwaukee, Wis., died at his home in that city on January 23.

L. W. Craus, supervisor of water service of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, died of pneumonia on January 12.

Roger H. Johnston, division engineer on the Chicago, Burlington & Quincy, with headquarters at St. Joseph, Mo., died of pneumonia in that city on January 14. Mr. Johnston was born on April 22, 1881, and graduated from Ohio Northern University. He had been division engineer at St. Joseph since 1921.

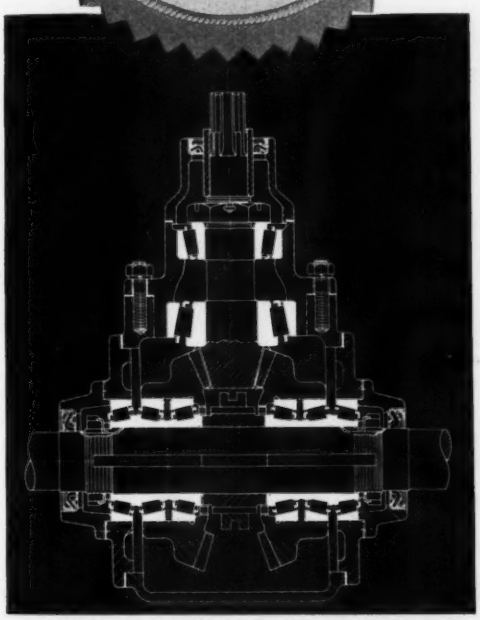
W. C. Harvey, who retired on December 1, 1939, as valuation engineer of the Chicago Great Western, with headquarters at Chicago, died of a stroke at his home in Chicago on January 26 after a long illness. Mr. Harvey was born at Waverly, Ill., on November 14, 1870, and graduated from the University of Illinois in 1892. After teaching and working on a number of engineering projects, he entered railway service in 1895 as a draftsman on the Illinois Central, later being promoted to instrumentman. A short time later he went with the Chicago Terminal Transfer (now the Baltimore & Ohio Chicago Terminal), as a bridge draftsman and assistant engineer and in 1901 he became chief draftsman on the Denver & Rio Grande Western at Salt Lake City, Utah. In 1902, he went with the Chicago & North Western as a draftsman and in 1905, he went with the Chicago Great Western as principal assistant engineer at St. Paul, Minn. Mr. Harvey was promoted to division engineer at Red Wing, Minn., in 1908, and in 1909, he returned to the general office as an assistant engineer, to handle the large improvement program following the reorganization of the property. In 1916, he was appointed valuation engineer, the position he held until his retirement.

Henry C. Nutt, retired president and general manager of the Monongahela and the Pittsburgh, Chartiers & Youghiogheny, and an engineer by training and experience, died at Cambridge, Mass., on September 26, 1942. Mr. Nutt was born at Council Bluffs, Iowa, on November 12, 1863, and entered railway service in 1883, as a rodman on the Burlington & Missouri River (now part of the Chicago, Burlington & Quincy), shortly after graduating from Yale University. In 1890, after serving in various capacities in the engineering department, he was promoted to trainmaster at Alliance, Neb. He later served on the Burlington as assistant superintendent at Edgemont, Neb., Sheridan, Wyo., and Burlington, Iowa, and general superintendent at Burlington and St. Louis, Mo.; as general superintendent of the Michigan Central at Detroit, Mich.; as general manager of the Western lines of the Northern Pacific at Tacoma, Wash., and as general manager of the San Pedro, Los Angeles & Salt Lake (now Union Pacific) at Los Angeles, Cal. In 1918, Mr. Nutt was commissioned a major in the U.S. Army Engineering Corps, A.E.F., and served in France and Germany. In 1919 and in 1920 he was president of the Coal Commission for Central Europe at Mahrisch-Ostrau, Czechoslovakia. He returned to the U.S. in 1921 and became president and general manager of the Monongahela and the P. C. & Y., with headquarters at Pittsburgh, Pa. He retired from active service in 1933.

(Continued on page 134)

Fairmont Gang Car equipped with Timken Bearings.

Give your section cars greater availability for Victory; use Timken Bearings on the axles and at all other suitable positions. Redesign if necessary.



Application of Timken Bearings in the reversing drive of the Fairmont Gang Car.

No other single feature so favorably influences the performance of section motor cars and trailers as the use of Timken Tapered Roller Bearings.

The application of Timken Bearings on the axles gives section cars advantages comparable to modern locomotives, passenger cars and streamlined trains.

They run with equal smoothness; require minimum time out for maintenance and lubrication; and above all, possess similar availability for service —a supremely important advantage.

Section car designers who use as many Timken Roller Bearings as possible produce not only *better* cars, but also *better selling* cars—for no other anti-friction bearings are so widely accepted and used by American railroads. The Timken Roller Bearing Company, Canton, Ohio.

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TAPERED ROLLER BEARINGS

"All There Is In Bearings"

The one test for every decision—
Will it help to win the war?

Association News

Wood-Preservers' Association

The members of the Executive committee of the American Wood-Preservers' Association met in Chicago on January 19 to consider the procedure to be adopted relative to the annual meeting which is scheduled to be held at Cincinnati, Ohio, on April 27-29, and to transact other business.

Bridge and Building Association

The Executive Committee has appointed Miss Elinor Heffern, secretary of the association, effective February 1, to succeed Miss Lorene Kindred, whose resignation has been necessitated by her removal to the Pacific coast. The office will remain as heretofore in Room 822, 310 S. Michigan Ave., Chicago.

Roadmasters' Association

Acting jointly with the American Railway Bridge and Building Association, officers of the Roadmasters' Association have selected Miss Elinor Heffern to serve as secretary of that organization, effective February 1, to succeed Miss Lorene Kindred, who has resigned because of removal to San Francisco, Cal.

Maintenance of Way Club of Chicago

The January meeting of the club, held on January 25, with 119 members and guests in attendance, was addressed by G. R. Westcott, assistant engineer, Missouri Pacific, St. Louis, Mo., who spoke on Work Equipment in These War-Time Days. In his address, Mr. Westcott spoke of the great importance of work equipment in the days immediately ahead, and urged the greatest co-operation on the part of those who assign the equipment, those who maintain the equipment, and those who use it, to the end that such equipment as is available will have maximum availability, maximum efficiency and maximum service life.

American Railway Engineering Association

As announced in the January issue, the association has cancelled plans for its annual meeting, which was scheduled to be held in Chicago on March 16-18, and, with the work of its technical committees completed for the current association year, no committee meetings were held in January and none are planned during February.

During the last month, Bulletin No. 436 was mailed to members, this bulletin including the reports of the committees on Wood Bridges and Trestles, Uniform General Contract Forms, Records and Accounts, Iron and Steel Structures, Waterproofing of Railway Structures, and Masonry. During January also, certain emergency provisions and specifications, adopted by the Emergency committee representing the Board of Direction, to supersede present standard specifications of the association, in whole or in part, in the interest of the war effort, were mailed to the chief engineering and operating officers of the railways. Among these were emergency specifications for soft and medium steel tie plates, adopted for the duration of the emergency to supersede the specifications for medium-carbon steel tie plates adopted in March, 1942. Another had to do with the adoption of the War Production Board's national emergency specifications for the design, fabrication and erection of structural steel for buildings, superseding, for the duration of the war, the association's specifications for buildings for railway purposes (iron and steel). Still another had to do with changes in the association's specifications for membrane waterproofing, affecting the ductility requirements of asphalt as a saturant and for mopping above ground.

During the first week in February, the last of the current committee reports will be mailed to members in Bulletin No. 437, this bulletin to include the reports of the committees on Roadway, Ties, Rail, Track, and Wood Preservation. The bulletin will also include another appeal from President Clarke for written discussion of the committee reports for review by the Board of Direction at the time of its action upon the various reports.

Supply Trade News

General

The Army-Navy "E" for excellence in production achievement has been awarded the Springfield, Ill., plant of the **Allis-Chalmers Manufacturing Company.** It was the first such award for tractor production.

"For accomplishing more than seemed reasonable or possible a year ago," the Army-Navy "E" award for excellence in the production of war material has been awarded the Peoria, Ill., and Stockton, Cal., plants of **R. G. LeTourneau, Inc.**

The Army-Navy "E" production award has been awarded three plants of the **Fairbanks, Morse & Co.,** Chicago. Presentation to the Freeport, Ill., plant was made on January 13, to the Beloit, Wis., plant on January 18 and to the Three Rivers, Mich., plant on January 21.

In recognition of "continued splendid achievement in outstanding production" the **American Steel & Wire Co.,** U. S. Steel subsidiary, has been granted a renewal of the Navy "E" award for excellence in production bestowed upon the company's Worcester, Mass., operations and employees on June 17, 1942. This renewal gives the company the right to add a white star to its Navy pennant.

The **Pomona Pump Company,** Pomona, Cal., its subsidiary the **Westco Pump Division** and the **Crocker-Wheeler Electric Manufacturing Company,** Ampere, N.J., have been acquired by the **Joshua Hendy Iron Works,** Sunnyvale, Cal. George A. McKenna, president of the Pomona Pump Company, together with the entire executive personnel, has been retained intact.

Personal

M. C. Morgan, field service engineer of the **A. M. Byers Company** has been promoted to assistant sales manager of the Pittsburgh division.

Arnold W. Nelson, has been appointed district representative of the **Allegheny Ludlum Steel Corporation,** with headquarters at Minneapolis, Minn., to succeed the **E. L. Sandberg Company.**

Charles A. Johnson, credit manager in the New York district of the **American Steel & Wire Co.,** U. S. Steel subsidiary, has been appointed assistant treasurer, to succeed **Robert Gordon,** who has retired.

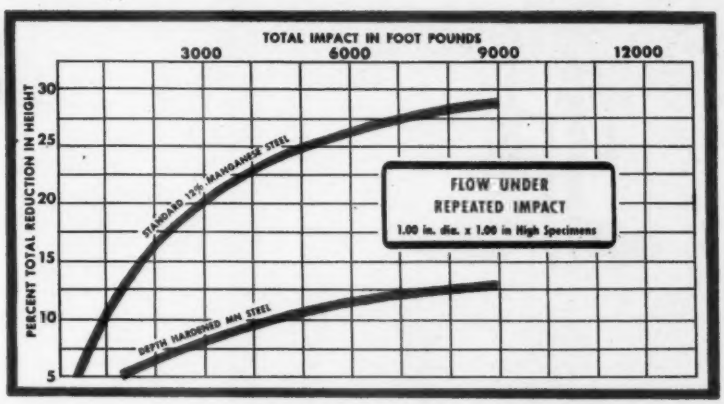
Obituary

Joseph S. Stockdale, district sales manager, Wood Preserving Division, Koppers Company, Pittsburgh, Pa., died suddenly on January 19, at the age of 57. Mr. Stockdale started his business career in the engineering department of the Pittsburgh & Lake Erie Railway, resigning in 1912 to become associated with the sales department of the Pittsburgh Wood Preserving Company, which later was absorbed by the Century Wood Preserving Company and then The Wood Preserving Corporation, now a division of Koppers Company. Mr. Stockdale helped in the early development of the wood preserving industry and for many years was active in the work of the American Wood-Preservers' Association.

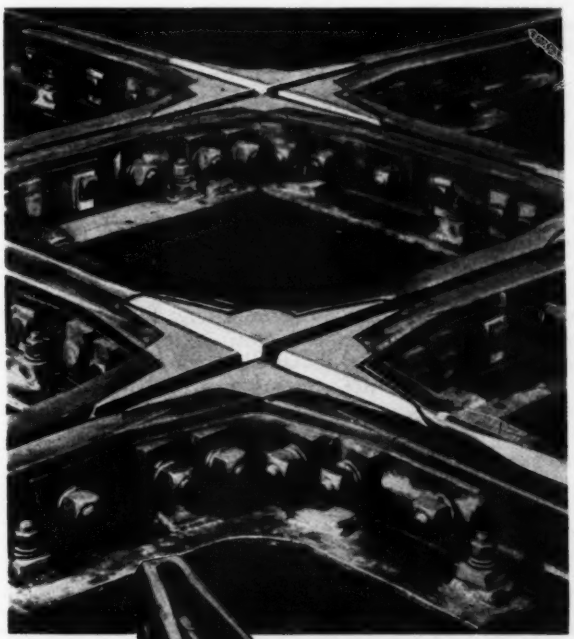
Presentation of the Army - Navy "E" Award to the LeTourneau Plant at Peoria on January 6.

Here's Another Way to...

CONSERVE VITAL METAL



• *Comparison of flow under repeated impact of standard and depth-hardened manganese steel.*



• *Racor Depth-Hardened Crossing.*

• *Underside of intersection showing anvil which protects casting from excess stresses during depth-hardening process.* 3201

An analysis of the illustrated laboratory chart, showing the comparison of flow under repeated impact of standard and Ramapo Ajax depth-hardened manganese steel crossings, will reveal:

The 11 per cent reduction in the one inch specimen of depth-hardened amounts to less than ⅛-inch, while the 27 per cent reduction for the standard manganese amounts to more than ¼-inch. In the field the same results have been found in hundreds of measurements. Field experience has also demonstrated that after this initial flow, either type of manganese will cease to flow.

As the running surface of a crossing will normally wear at least 1/16th-inch, this would leave a scant 1/16th-inch drop at the intersection on the depth hardened, as against a full 3/16-inch for the standard manganese. This difference is sufficient to cause shattering blows when rapidly moving wheels pass over the standard manganese crossing, causing the corners to spall and subjecting the balance of the crossing to terrific stresses because of the bouncing effect of rapidly moving wheels.

We will gladly furnish detailed information.

THE AMERICAN
Brake Shoe
AND FOUNDRY COMPANY

RAMAPO AJAX DIVISION

Official U. S. Marine Corps photograph

Official U. S. Army Signal Corps photograph

Official U. S. Navy photograph

"In the Service"

"Bill, I understand that another of your boys has entered the service," said the railway sales manager to his star salesman.

"That's right, Boss," replied the star salesman. "He's the third to go."

"That's a great record. Where are they?"

"Bill Junior's with the Marines in the Solomons: John's in one of the railway battalions in Africa and Fred's going into the Navy."

"This war's coming close home to you, isn't it?"

"I'll say it is. I'd be in it myself if I wasn't too old, but since I can't get in, I'm doing the best I can to back these boys up."

"We all ought to do that. But what are you doing especially?"

"I'm doing everything I can to help the railways carry the munitions, planes and other supplies these boys need at the front. I've never worked so hard in my life."

"I've noticed that, but I don't yet see the connection."

"It's this—these railways are fighting with their backs to the wall—handling over 30 per cent more traffic than ever before in their history—and they're desperately short of materials and men."

"That's all true, but I still don't see the connection with your work."

"Heck, Boss—doesn't our equipment help the roads keep their tracks up in normal times—and if that's true, isn't it doubly helpful in times like these when the roads can't get the labor they need? Can't you see that they need us and our equipment more now than ever in order to keep going at all?"

"I see your point. We *are* making a very direct contribution to the railways' efforts to keep going and through them to the country's all-out war effort. It's too bad we can't tell that story to *all* these railways for we *can* help them."

"Why do you say that? We *can* tell our story to these other roads."

"How? You're working day and night now. You can't keep up the pace you're now following—let alone increase it—and you're not able to see half the men who ought to know our story."

"That's true—but I've got a plan to increase our contacts."

"What is it?"

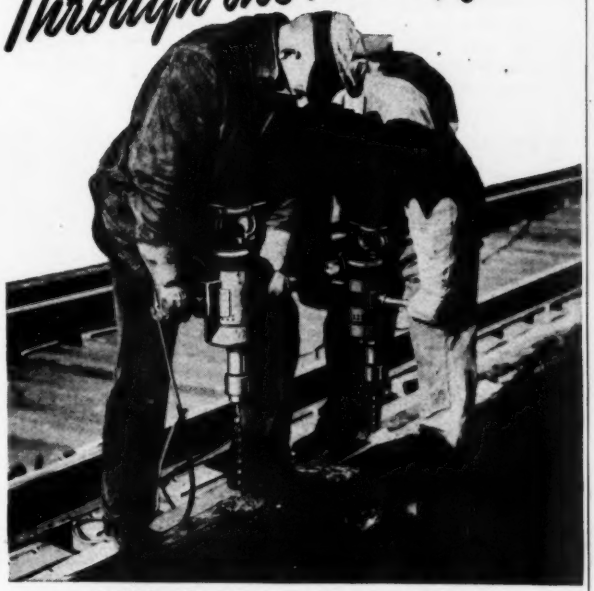
"It's the use of more advertising in *Railway Engineering and Maintenance*—enough to tell our story to these men whom I can't get around to see—and to keep our story before the others between calls."

"Are you sure they'll read it?"

"If you have any doubts, ask *any* railway maintenance man. They all read it—they take it out on the line with them—they discus its contents with their foremen. It's their Bible."

"That's right, Bill, I've found that to be true. It *is* the magazine to reach these men. You've got a real idea. I'll arrange to increase our space—it'll double your contacts and back up your boys and the other fine lads in the service."

Work Crews "Highball" Through the Heavy Jobs



With the No. 342 — ¾ inch STANLEY ELECTRIC DRILL

With rail traffic breaking all records, every minute saved in construction and maintenance today is worth an hour in normal times. Your work crews can get a lot more done in less time when you equip them with Stanley No. 342 Electric Drills.

They are built throughout for *heavy duty*—boring holes without stalling on trestles, platforms, underpasses, etc. Balanced for easy handling, they are quickly adaptable for use in hard-to-get-at places.

The power-packed universal motor operates efficiently from either a portable generator set or standard power lines. Set up in a Stanley Drill Stand, the No. 342 becomes a rugged, portable drill press.

Ask for a demonstration or specification sheets. Stanley Electric Tool Division, The Stanley Works, New Britain, Connecticut.

1843 STANLEY TRADE MARK 1943

STANLEY ELECTRIC TOOLS

On RIGHT-OF-WAY Maintenance and Construction

Mall 5 H.P. Off-the-Track PORTABLE POWER UNIT

The 5 H. P. variable speed gasoline engine operates 8 quickly interchangeable tools for Circular Sawing, Grinding, Sanding, Drilling, Pumping, Wire Brushing, Concrete Vibrating, Concrete Surfacing and Sharpening Tools. It operates all day on very little fuel. The flexible shaft that transmits power to tools is properly insulated to protect signals. Off-the-track feature reduces accident hazards.

NEW Mall ¼" DRILL 143T

A light-weight, cool running drill for continuous metal drilling under full load. Has free speed of 2850 r.p.m. and full load speed of 1850 r.p.m. Pistol grip and trigger switch simplifies use with either hand. Equipped with universal motor and ventilating fan. Easily and quickly serviced.

Mall CHAIN SAW

5 H. P. **GASOLINE ENGINE MODEL**

A powerful, time and labor-saving tool that squares heavy timbers and logs to size, and fells trees with surprising speed. Operates all day anywhere on right-of-way on very little fuel. Swivel feature permits cutting at necessary angles. Motorized sharpening device for sharpening right on the job. Easily transported on a hand car. Available in 24", 36" and 48" cutting capacities. Also pneumatic models.

Literature and prices upon application.

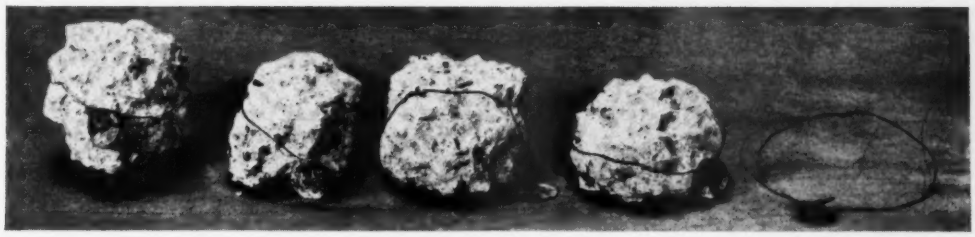
RAILROAD DEPARTMENT

MALL TOOL COMPANY

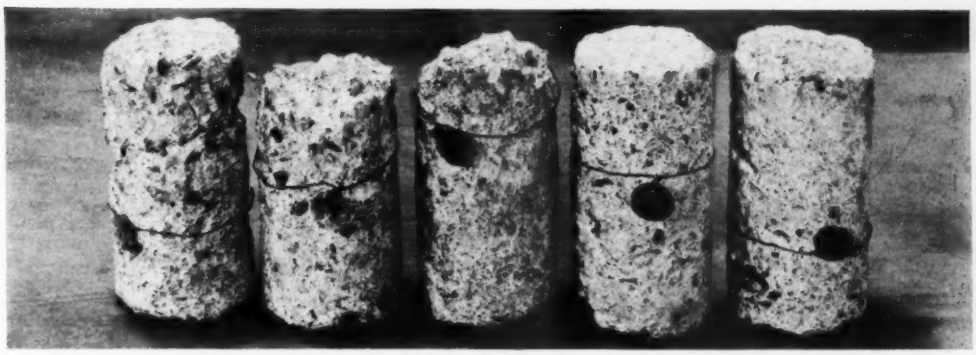
7746 SO. CHICAGO AVE. · CHICAGO, ILL.

ALPHABETICAL INDEX TO ADVERTISERS

Water reduced up to 20% with POZZOLITH (CEMENT DISPERSION)... improved placeability

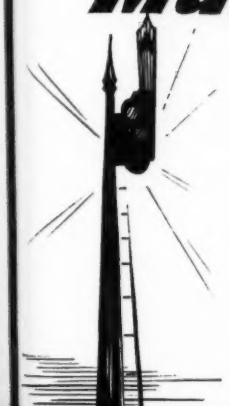


Plain Concrete — 150 Cycles of Freezing and Thawing, LOSS IN WEIGHT — 73%.



Pozzolith Concrete (Dispersed) Same Design and Consistency
150 Cycles of Freezing and Thawing — LOSS IN WEIGHT — 10%.

"Margin of Safety" in concrete



DISINTEGRATION by freezing and thawing is primarily dependent on (1) the ability of water to penetrate into the concrete where it will freeze, expand and break down the structure (2) on the strength of the cement paste to resist this force.

Pozzolith through Cement Dispersion reduces permeability and makes concrete more watertight, because (1) it increases workability as measured by the slump 150%. Water therefore, can be reduced 15-20%, at the same time maintaining easier placeability and increasing strength, (2) Cement Dispersion exposes the entire surface area of cement particles to hydration, producing a finer grained structure in the cement paste, and increasing cement efficiency.

Because Pozzolith permits reduction of the water-cement ratio, it insures that *margin of safety* in the field, so important in producing sound durable concrete.

Write for the complete story on Cement Dispersion and illustrated Pozzolith booklet.

THE MASTER BUILDERS COMPANY
CLEVELAND, OHIO — TORONTO, ONTARIO

OTHER MASTER BUILDERS PRODUCTS USED EXTENSIVELY BY RAILROADS

EMBECO — non-shrink grouting and concrete repair material.
MASTERPLATE — non-colored and colored armoured surface floors.
OMICRON MORTARPROOFING — shrinkage control for masonry mortars
MASTERKURE — membrane curing agent for all concrete.

MASTER BUILDERS

POWERFUL AS A TORNADO

Easy-breathing — yet packing all the wallop of a charging storm — this Rail Car Compressor, a Worthington Blue Brute, is built for maintenance men who want more air, under complete control, at lower cost.

You'll like its *smoother, steadier* power, economically controlled by Worthington's repair-free Feather* Valves. You'll cut your costs and downtime on those vital road-laying, road-maintaining jobs that keep our wartime traffic rolling!

There are Worthington Blue Brute Compressors to meet your every need; self-propelled and non-self-propelled; on skids or wheels; gasolene, diesel or electric-driven; available in 60 to 500 cubic foot sizes — all with Worthington's outstanding economy, ease of operation, freedom from maintenance worries.

With Worthington Blue Brute Rock Drills and Air Tools *using less air,* while Blue Brute Compressors *deliver* more air, you'll find yourself getting more *worth* from air, this year, and for years to come.

Behind the Fighting Fronts with

BLUE BRUTES

Blue Brutes — in uniforms of olive drab and battleship gray‡ — are at work in Australia today, in building and maintaining new supply lines under General MacArthur's command. Blue Brutes are doing similar jobs for Uncle Sam in hundreds of Army camps, Navy yards, air bases and ordnance plants behind our fighting fronts.

*Reg. U. S. Pat.
‡Blue Brute Compressors and Air Tools are painted olive drab for the Army and battleship gray for the Navy.

Get more WORTH *from air with* WORTHINGTON

BUY BLUE BRUTES

Compressors from 60 to 500 cu. ft. capacity in mount- always set the pace for easy operation — available in

WORTHINGTON

Worthington Pump and Machinery Cor poration Harrison, N. J. Holyoke Com pressor and Air Tool Department